the OIL AND GAS
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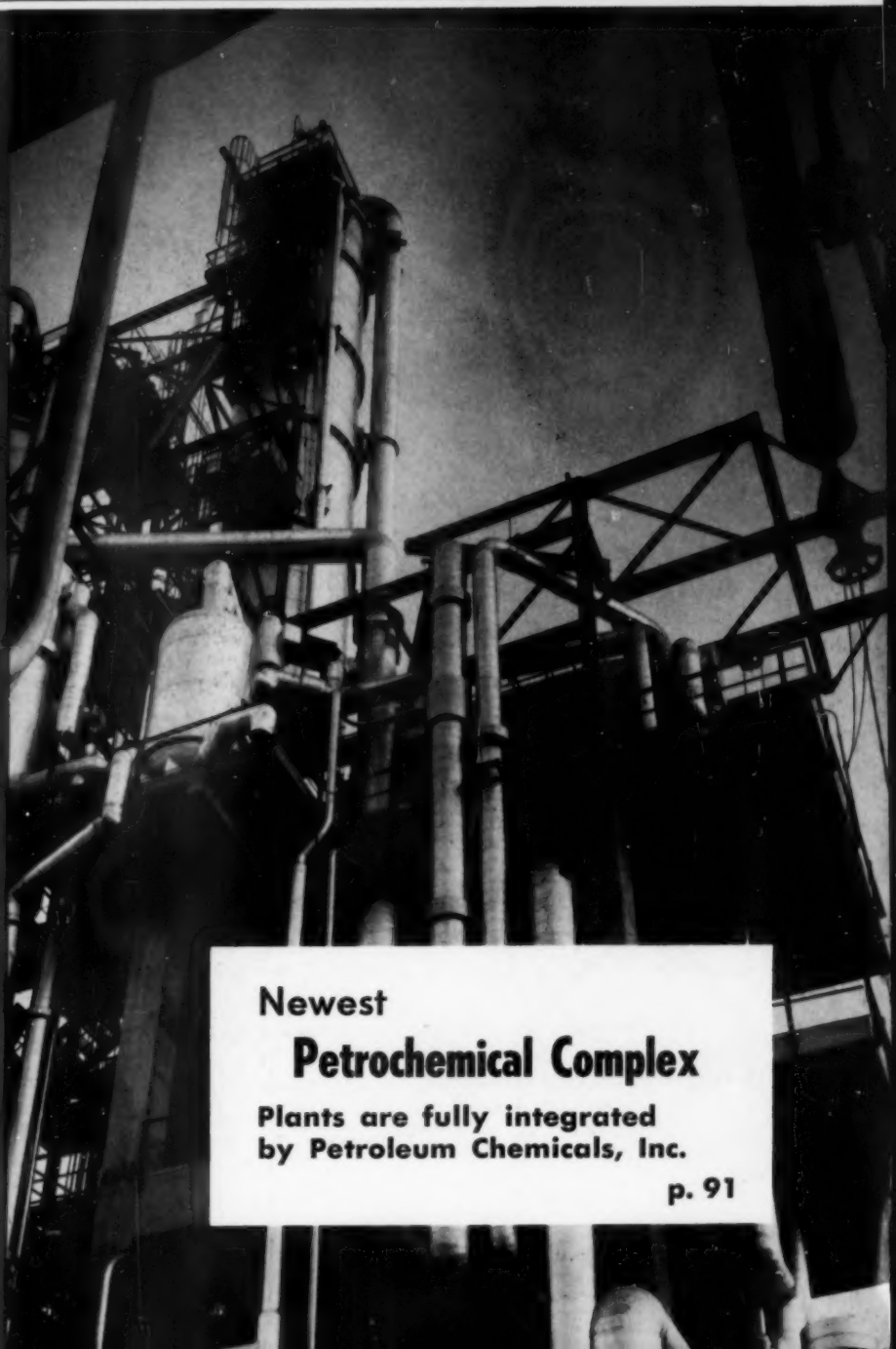

Pinch on Refiners Eases as Crude Prices Fall and Product Prices Increase

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Horseshoe Canyon Grabs Four Corners Spotlight with Shallow Play

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Big Lease Sale Points to Pickup in Drilling in Gulf off Louisiana

p. 64

Newest
Petrochemical Complex
Plants are fully integrated by Petroleum Chemicals, Inc.

p. 91

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The pulsebeat of power for our civilization vitally depends on the subsurface arteries of oil . . . arteries that constitute a lifeline of energy, sustaining the progress of today and tomorrow.

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DUNCAN, OKLAHOMA

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 2, 1959

Company reports show how much ground oil lost in '58:

First 43 earnings statements from oil firms indicate 1958 profits in industry will be off an average 24.6%.

This is much sharper profits drop than the 14.4% average decline experienced by U. S. industry as a whole.

What's more important, the domestic oil industry still may not have fully recovered. Says Morgan Davis, president of Humble, nation's top domestic producer:

"Humble and the domestic petroleum industry have not fully recovered from downward adjustments occasioned by the recent recession. Humble's crude production still is restricted to less than one half of the volume which could be produced efficiently through existing wells.

"Also, operating costs have been increased since the first of the year by an industry-wide general wage increase.

"Immediate prospects are for continued emphasis on economical operations and highly selective capital spending."

Humble's net dropped to $136.5 million from $175.9 million year before. Gross revenue dropped $116.8 million. Biggest drop was in crude sales, but sales of petrochemicals and products also were off. Natural-gas revenue boomed.

Real belt tightening offset the lost revenue somewhat. Expenses were cut $77.5 million, including a $26.2 slash in dry-hole costs. Company drilled 310 fewer wells. Capital expenditures were lopped by $80.5 million.

Sinclair broke sales records and crude-production records, but net income still dropped to $49.5 million from $75.3 million.

The sales and production successes were offset by depressed product prices, higher costs, and a retroactive jump in Venezuelan income tax rates.

Tidewater's net nearly dropped through the floor—from $34.9 million in 1957 to $2.6 million in 1958.

President George Getty blames these factors for showing: limited access to low-cost raw materials because of controls on imports, inequitable imports quotas for Tidewater, subnormal prices for refined products, and restricted domestic production.

Tennessee Gas Transmission had an enviable year. Net income jumped 15% to $46.4 million. Operating revenues were up 8% with gas deliveries alone up nearly 6%. Future also looks good: Plans for new projects now in the mill would step up gas deliveries 25%. Company also is mapping greater activity in exploration, refining, and marketing.

Other earnings:
Hudson's Bay $1.3 million from $3 million; Interstate Oil Pipeline $4.5 million from $4.1 million; Maracaibo Oil Exploration $337,446 from $938,458; Signal $17.4 million from $21.1 million; Indiana Standard $117.8 million from $151.5 million; Ohio Standard $24 million from $23.9 million; TGT $46.4 million from $40.4 million; Trans Mountain Oil Pipe Line net loss of $143,000 from $8.3-million profit; TXL Oil $3.7 million from $4.3 million; Wilcox $909,982 from $891,025.

▼ ▼ ▼

Domestic refiners are closing out a good winter season.
Total demand has been exceptional since late November.
Level of product prices has risen—especially the middle distillates and even heavy fuel oil.
Cost of crude oil, refiner's major expense item, has gone down steadily.
Best barometer: Refiner's spread between cost of crude and income from barrel of products has increased. His gross income is approaching pre-Suez levels (p. 59).

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Bill cutting oil-gas depletion allowance from 27½ to 15% faces strategic amendment in the Senate.
Look for proposal to plug other so-called tax "loopholes" by cutting in half the depletion allowances on other minerals. These range from 5 to 23% on some 30 or 40 items.
Senators sponsoring the cut on oil thus may hear from constituents producing gravel, fire clay, building stone, etc.

Depletion issue is back of one-man revolt in Senate of William Proxmire against Majority Leader Johnson.
Both are Democrats. There the similarity ends. Proxmire is a leading foe of depletion for oil. Johnson one of its defenders. Proxmire also is upset because Johnson refused to appoint him to Senate finance committee.

Plans for atomic-powered submarine tanker are shelved.
Congress wants to consider a more economical proposal to help finance atomic surface tankers.
Maritime Administrator Clarence G. Morse says the submarine is justifiable only on defense grounds. Surface tankers, however, could reduce disadvantages now faced by U. S. shippers competing with foreign vessels.

Price tag is $35 to $40 million on a 40,000-ton atomic submarine tanker. Cost is only $15 million to jumboize an existing vessel and convert it to atomic-powered tanker.

Joint Committee on Atomic Energy is expected to come out soon with federal-aid plan to encourage the surface tanker. Esso Standard has offered to build atomic tanker if U. S. will finance additional cost over conventional ship.

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Hot spot in Four Corners now is Horseshoe Canyon field in northwest New Mexico.

Play is sparked by two shallow pays—Gallup and Tocito of Cretaceous age. Drilling is easy and wells consistently flow at rates above 100 bbl. daily.

So far, 6,000 acres have been proved by the more than 80 wells. Most of these have been drilled within a year. Outlook now is that Horseshoe Canyon will be linked with Verde Gallup field to the east (p. 62).

Leases on highway right-of-way will be granted by Texas' newly created Board of Lease of Highway Department Lands.

Board will submit specific tracts for leasing by March 5. Bids will be opened on April 7. State has some 200,000 acres of mineral rights along highways, 26,000 in oil or gas areas.

Two recovery methods have been suggested. One would permit directional drilling from adjoining property. Other calls for pooling state's interest with adjoining property owners to use a common well (p. 61).

Offshore Louisiana is now assured of drilling upturn.

That clearly is the lesson from the record-breaking sale of leases held at Baton Rouge. Sale netted $61.4 million in bonus payments. Highest bid was $3,000 an acre with average at $652 (p. 64).

Guarantees of heavy new drilling—both offshore and inland—were extracted from the bidders. Most of the contracts require drilling first year or a penalty of one-half the bonus will be assessed.

Interest in leases prompted Louisiana to plan another sale in July. There are indications the federal Government may join in offering offshore tracts at that time.

Phillips has a record producer in gas-rich Southeast Texas.

A new well, the Phillips 1 Prets in Northeast Hitchcock field of Galveston County, is rated at 840,000 M.c.f. daily. Pay is from the 9,100-ft. Frio sand. The gas yields 52.3°-gravity distillate at ratio of 1 bbl. to 92 M.c.f. of gas.

Well is Gulf Coast's largest gasser. Previous record was well completed last May in Jefferson County's West Big Hill field with potential flow of 780,000 M.c.f. daily.

Refinery use of fluid catalyst in cat cracking is down to about 0.3 lb. per barrel of throughput, a drop from 5 years ago when 0.5 lb. per barrel was the average.

Trend is due to combination of factors: Improvements by catalyst manufacturers and more efficient refinery operation conditions.

Drop in consumption rate, however, may have reached an end. Inactive catalyst must be removed from units to maintain proper degree of activity. Certain amount of catalyst loss is considered routine.

Proposed atomic blast in Colorado's oil shale deposits may be scaled down. Small test to determine oil-recovery possibilities now seems best bet.

Mines Bureau Director Marling Ankeny indicates he now will settle for a small thermal recovery experiment. He still seeks help, however, on financing the big blast.

His dozens of letters to oil and service companies aim to find how many are willing to contribute to the test—either on a large or small scale.

Door is open now for new liquid-gas industry.

Maiden voyage of Methane Pioneer from Louisiana to London is a success. Its backers flatly say ship is merely the first and smallest of a fleet of methane-carrying vessels to be built in the future (p. 88).

The voyage means that gas for domestic and industrial fuel now can be delivered to any energy-deficient country in world.

Another tanker voyage also hit the headlines last week with the most controversial oil cargo to unload in New York in years.

An Italian ship brought in 100,000 bbl. of low sulfur residual fuel oil from Rumania for Commerce Oil Corp.

High-strength line pipe with 60,000 psi. yield is expected to be used this year for the first time.

The X60 pipe is planned for small-diameter product service.

▼ ▼ ▼

At the statehouses: California legislature probably will pass a new air pollution control bill aimed at motoring public. Planned bill calls for autos to be equipped with proper smog eliminators and to be inspected periodically... Texas Gov. Price Daniel may seek state investigation of anti-trust violations in recent crude-price cuts...Kansas district judge at Garden City has ruled invalid allowable orders of corporation commission in Hugoton gas field for last 4 months. Earlier ruling had killed allowables for 3 previous months... Nebraska legislative committee has approved changes to state conservation law.

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MARCH 2, 1959 • VOLUME 57 • NUMBER 10

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY—OPERATION

Refining-Processing

SPECIAL SECTION: Petroleum Chemicals, Inc.'s Plant Expansion 91-106
Edited by John C. Reidel

Interchange of Materials Insures Complete Byproducts Processing 91
By H. S. Burk and I. E. Thibodeaux
The Petroleum Chemicals, Inc. - Calcasieu Chemical Corp. petrochemical plant complex at Lake Charles, La., is designed for full processing of refinery byproduct streams. Also, byproduct streams from each plant in the complex are interchanged so that only a few squeals are left unused in the petrochemical pig.

Ethylene Process Is Low Temperature, Highly Efficient 94
By William Tucker, C. G. Kevil, and P. M. Ableson
High-purity (99.7-plus %) ethylene is made with single demethanizer and single ethylene fractionator. Plant has consistently exceeded specified ethylene purity. Offgases are produced in two streams, one rich in hydrogen and the other in methane.

Ammonia Plant Is Compact, Flexible 100
By J. O. Hartman and C. F. Mackey
Plant handles a variety of hydrogen-bearing feed streams. Maintenance of safety requirements in low-temperature processing is aided greatly by use of IR stream analyzers in air-separation unit, monitoring acetylene and other impurities in air intake and oxygen.

Ethylene Oxide Process Utilizes Catalytic Oxidation 104
By C. G. Kevil and R. H. Lyles
The instrumentation system is all electronic and employs special loops to obtain close control. A data logger-scanner system can scan 100 temperatures in 30 seconds. Stream analyzers are used in the air separation plant for safety purposes.

WPRA Refining Quiz—2: Refinery Maintenance 127
Here is the material developed on refinery maintenance at the latest El Dorado, Ark., regional meeting of Western Petroleum Refiners Association. This is the second portion of the transcript for the 2-day session. The remaining material will be published in weekly installments.

Pipelining

Water-Test Nomograph Tells Source Pressures 139
This tool allows the determination of proper pressure to be applied at various water sources when testing a new pipeline.

Oil-Soluble Inhibitors May Solve Corrosion Problems 139
Use of these agents to protect pipelines is growing rapidly.

Here Are Pipeline Safety Fundamentals 141
Tips on how to greatly increase safety in pipeline maintenance.

Drilling-Production

Lost-Circulation Materials—Which to Use and How to Use Them 110
By B. Q. Green
Part 1 of two parts. New tests show that the seal must take place inside the opening, not on its face. Fifteen pounds of lost circulation material per barrel of mud is about the optimum. Materials are more effective if a waiting period is used.

Reservoir Engineering—6 119
By E. T. Guerrero and F. M. Stewart
Here's how to measure absolute permeability when (1) Using linear flow and compressible fluid, and (2) Using linear flow and noncompressible fluid. Examples of problems' solution and discussion are included.

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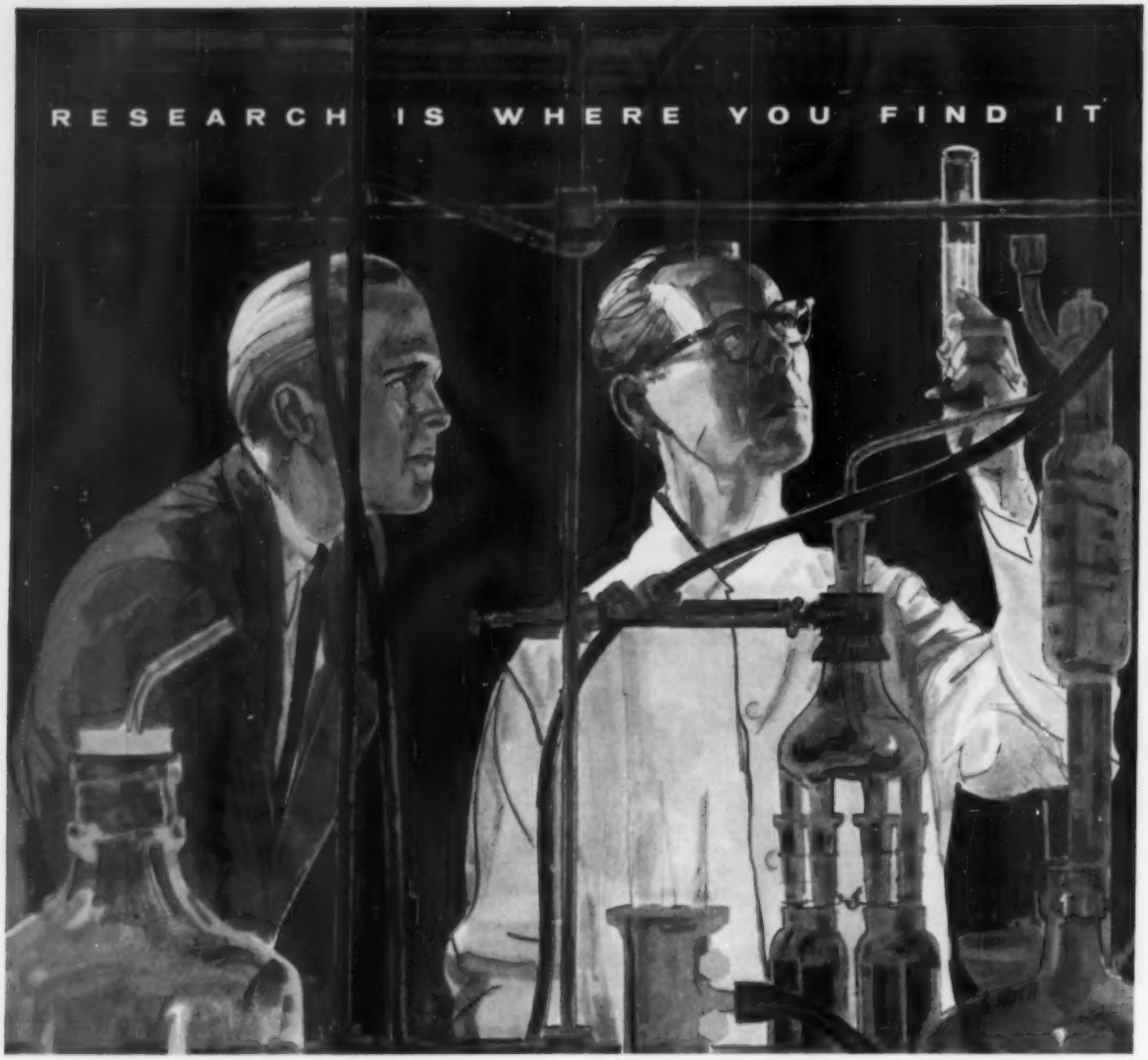

A slight case of poison

A sudden mysterious "sickness" can disable a petroleum refinery, much as it does a human. Which is just what happened at this refinery.

Universal service engineers were summoned in a hurry. Samples of feedstock and catalyst were rushed to UOP laboratories, where petroleum chemists set to work. Here, the usual analyses found nothing, but specially developed analytical procedures determined the cause of the trouble—arsenic in the feedstock was poisoning the platinum-containing catalyst.

Today, in the widely-used UOP Platforming® process, proper techniques are available to assure that the feedstock reaches the reactors completely free of arsenic. The presence of arsenic in feedstock no longer prevents the effective and economical use of the process for producing high octane gasoline and high-purity petrochemicals in hundreds of refineries throughout the free world.

Many refining ideas are born in Universal's laboratories. Others, such as this, grow from problems encountered in commercial operations. But at UOP we believe that "research is where you find it." No matter where a research idea may originate, if it advances the art of petroleum technology it deserves to be carried to a successful conclusion—and to be made available to refiners everywhere. *Trademark

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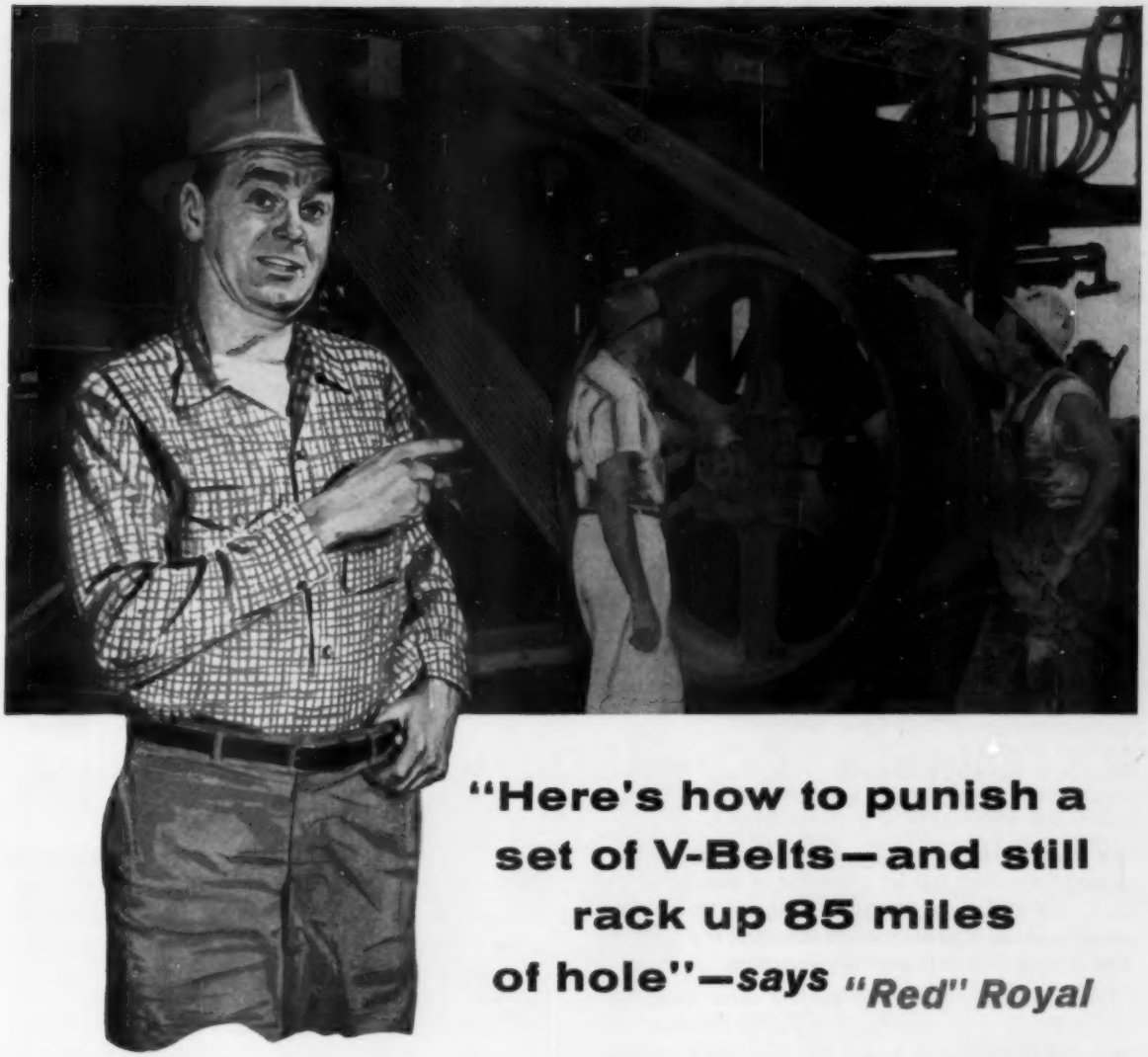

"Here's how to punish a set of V-Belts—and still rack up 85 miles of hole"—says "Red" Royal

"Red" has just been talking to the tool pusher and crew of the Holmes Drilling Co. rig #6. They're getting ready to disassemble the V-Belt drive and move it to another location. Here's what they told him:

"The hardest wear to which a V-Belt drive can be put is to be frequently dismantled and reassembled at different locations. Invariably, you run into misalignment problems until the two sheaves can be juggled into proper position. This causes the V-Belts to take a beating, which is aggravated by the number of times the drive is moved."

Yet this set of U.S. Rubber belts was on 58 different holes, drilling almost 450,000 feet—85 miles—in 5 years!

Adds the drilling superintendent: "These belts operated practically 24 hours a day. They were given only normal company maintenance. At no time did we have a major shutdown due to belt failure."

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Over and above the support they impart to the coupling body, these two CO-HARD bands provide hard, slow-wearing bearing surfaces. The body itself does NOT become worn, but retains its inherent capacity to withstand continuous heavy loads. In addition, CO-HARD's extremely low coefficient of friction minimizes the normal galling action which results when ordinary surface-hardened couplings contact tubing walls, and this adds materially to tubing life, especially in crooked wells. Should fishing jobs occur, fishing sockets slip over the CO-HARD band and get a firm grip on the band shoulder.

See the new CO-HARD Sucker Rod Coupling at your nearest "Oilwell" store! Try it on your next string of rods! You will find it saves you money through longer, more efficient service.

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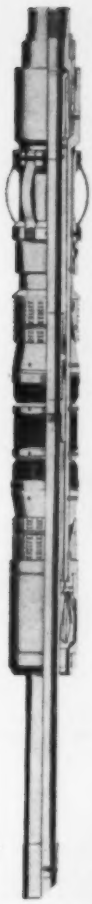

Type "C" Production Packer with Standard Sealing Unit

The deepest test ever made with Production Packers or any other tools was recently completed by Phillips Petroleum Company in Pecos County, Texas.

Phillips chose two Halliburton Type "C" Production Packers for the unique job of successfully isolating, treating and testing a zone from 24,897 ft. to a T. D. of 25,340 ft. in the world's deepest hole.

Halliburton Special Tools Operators running Type "C" Production Packers for the world's deepest test in Phillips Petroleum Company's No. 1-EE University Well, Pecos County, Texas.

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The first packer was run and set in 13 hours and 60 seconds. Rate of descent was 30 seconds per 90 ft. stand, in 7⅝ and 7 inch casing to top of liner at 22,682 ft; then 75 seconds to 90 seconds in 5" liner to desired depth.

The second packer was set six feet above first packer. Both packers easily set in normal manner—pipe was rotated to set upper slips; an upward pull on drill pipe expanded packer, set lower slips and sheared tension sleeve freeing drill pipe and double seal units from packer before job began.

The packers were subjected to extremely rigorous conditions through loading and circulating drill pipe to surface, swabbing jobs, pressure testing many times to 10,000 psi and pumping into formation and treating bottom zone near 10,000 psi. Packers were unaffected by bottom hole temperatures of 320°F.

More than 37 Halliburton Production Packers have been successfully used for this purpose in 3 wells in the Pecos County Area alone!

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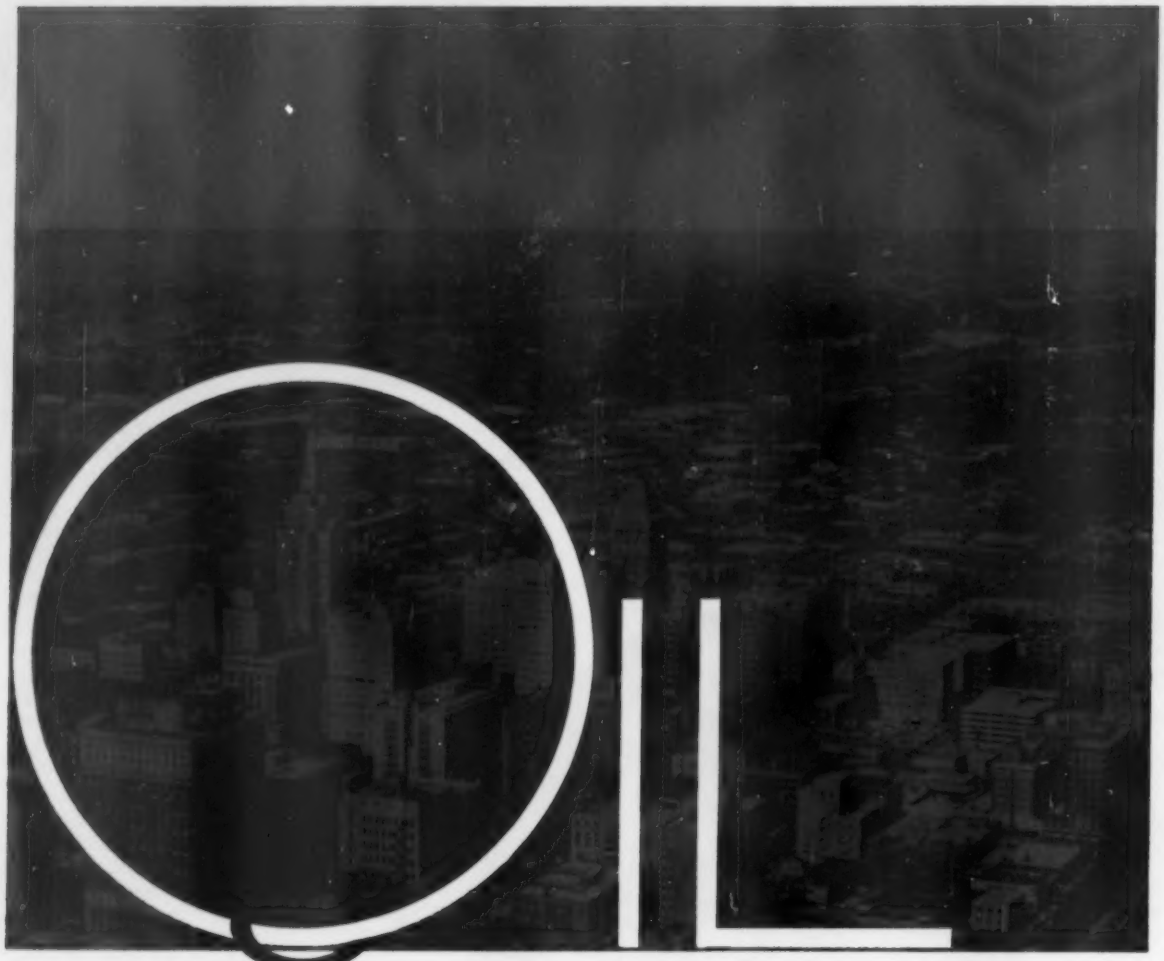

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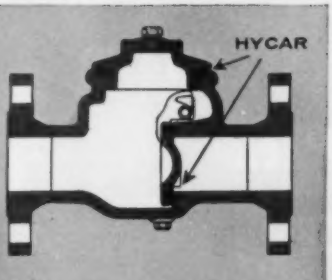
HYCAR SEAT FOR CHECK VALVES SEALS SECURELY FROM -60° TO 300°F

SELECTING the proper compound from which to make the "O" rings for this self-sealing Stream-Flo Swing Check Valve proved a problem . . . until Hycar nitrile rubber was tested. It provides effective sealing in intermittent service up to 350°F., in continuous service up to 300°F., with a lower temperature limit of –60°F.

For applications like this, Hycar nitrile rubber is ideal. Its outstanding resilience under a wide range of temperature conditions means that it can withstand repeated and severe mechanical deformation. Since it lives with hydrocarbons that would destroy other types of rubber, it can be used for natural gas, distillate, and sweet and sour crude oil.



Two Hycar "O" rings, one for clapper seal and one for the top cover seal, are used in Stream-Flo Swing Check Valve made by Charles Wheatley Company, Tulsa, Oklahoma. "O" rings are manufactured by F. H. Maloney Co., Houston. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber material only.

Hycar may be the material that will help you get more results in your application. For technical information, write Dept. CE-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio.

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GOOD-RITE chemicals and plasticizers • Harmon colors

. . . BECAUSE they must do the job well

Based on established standards, Larkin Centralizers take 45% less permanent set than maximum . . . exert 300% more initial centering force than minimum required.

Based on field performance, Larkin Centralizers provide convenience of installation, ease of starting, maximum centering force and minimum permanent set. There's a size and range for every condition. Specify Larkin Centralizers . . . through your supply store.

LARKIN CASING CENTRALIZERS ARE DESIGNED AND PROOF-TESTED TO EXCEED ANY KNOWN STANDARD FOR CENTRALIZER PERFORMANCE

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

PESA

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

For Quick Delivery—
Order Heads from Bethlehem stock

Bethlehem stocks a wide range of sizes of flanged-and-dished heads for prompt delivery. Available in ASTM Spec. A-285, Grade C Flange, or Firebox steel, they meet the requirements of the ASME Code for boilers and unfired pressure vessels.

Bethlehem produces a full range of flange-mill products to meet your needs. For more information on flanged-and-dished heads, just phone or write the nearest Bethlehem sales office. Or write to us direct, at our home office in Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

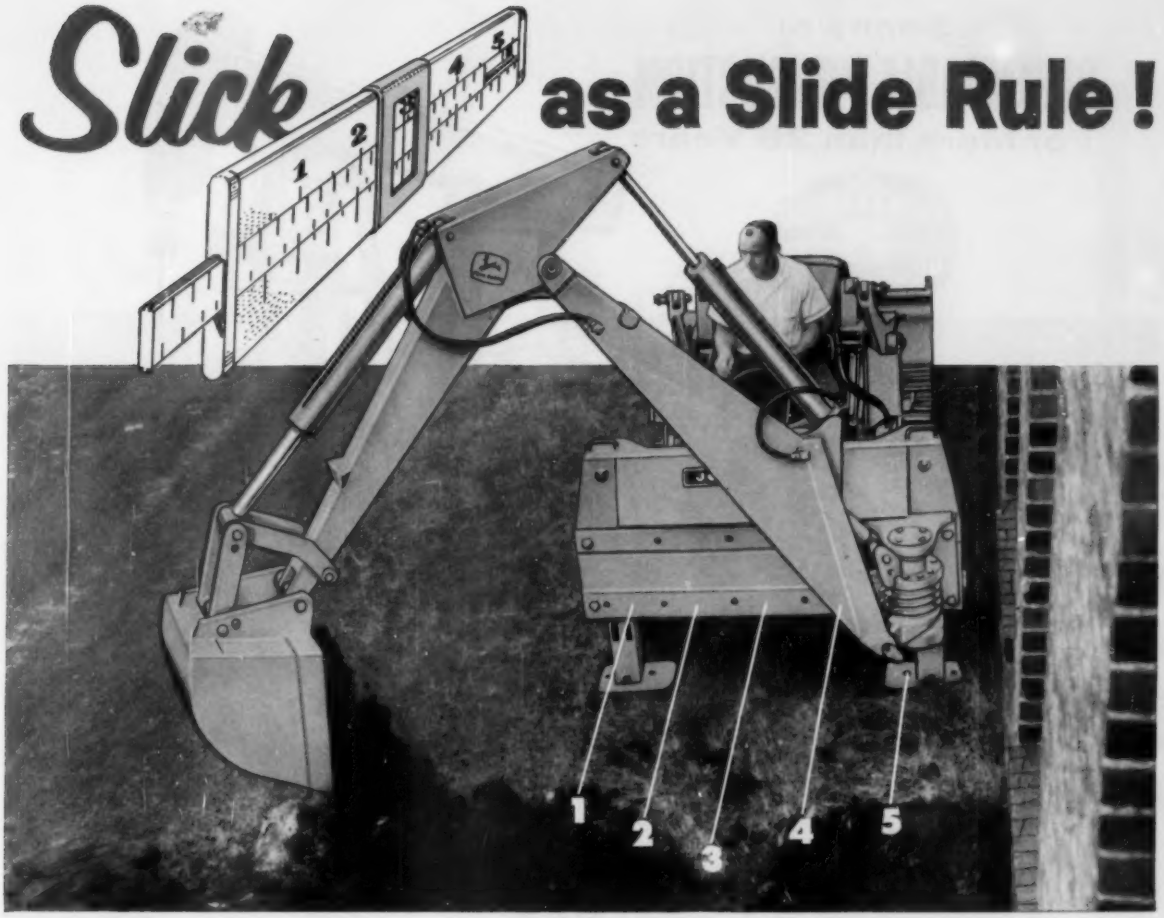
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Mast Down... Well Completed!
Operators and contractors in the San Juan Basin require highly portable drilling rigs for fast moves over difficult terrain. Here, a rig equipped with a Mid-Continent U-36-A drawworks has completed a gas well near Blanco, New Mexico, and is being prepared for movement to a new location. The highly portable U-36-A is ideal for the Four Corners area, providing convenient movement, fast drilling, and extra depth capacity. A single package rig when skid mounted, the U-36-A can also be trailer mounted with the mast. For drilling to depths requiring 300 to 600 H.P. input, and high portability, equip your rig with a Mid-Continent U-36-A drawworks. See your Mid-Continent representative for full details.
DW1-D
MID-CONTINENT SUPPLY CO.
MID-CONTINENT BUILDING • FORT WORTH, TEXAS
Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK
THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Slick as a Slide Rule!



New JOHN DEERE 5-Position BACKHOE

Shifts Boom in 15 Minutes!

Finished that job of flush digging already? To change the boom mounting for a different job with the John Deere 51 Backhoe, here's all that's required: Just drop the bucket to the opposite side, remove four bolts and *slide* the boom mounting wherever you want it on the pad . . . using the boom's own hydraulic power. All hydraulic connections stay intact. At the outside, it's a 15-minute job for one man, using only a wrench.

For transport, leave the boom mounted at left or right. Boom then folds snug up against pad to make a superbly compact and well-balanced unit for the road. Ask your John Deere dealer for a demonstration.

Some "51" Features

- ★ Simple 2-lever control speeds digging.
- ★ Great new breakout power for hard digging.
- ★ Ground-level reach—20 feet, 9 inches; working depth—13 feet, 6 inches; dumping height—11 feet; boom travel—180 degrees.
- ★ Backhoe can be removed from tractor in five minutes.

JOHN DEERE Industrial Tractors and Equipment

The center-mounted John Deere 50 Backhoe has 205-degree boom swing. In tight spots, digs at 90-degree angles to tractor.

SEND FOR FREE LITERATURE

JOHN DEERE INDUSTRIAL DIVISION
Moline, Ill. • Dept. D-46-M

Please send detailed information on John Deere Industrial Tractors with new ☐ 5-Position ☐ Center-Mounted Backhoe ☐ Other Equipment for Builders and Contractors.

*Name*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

Sentry of

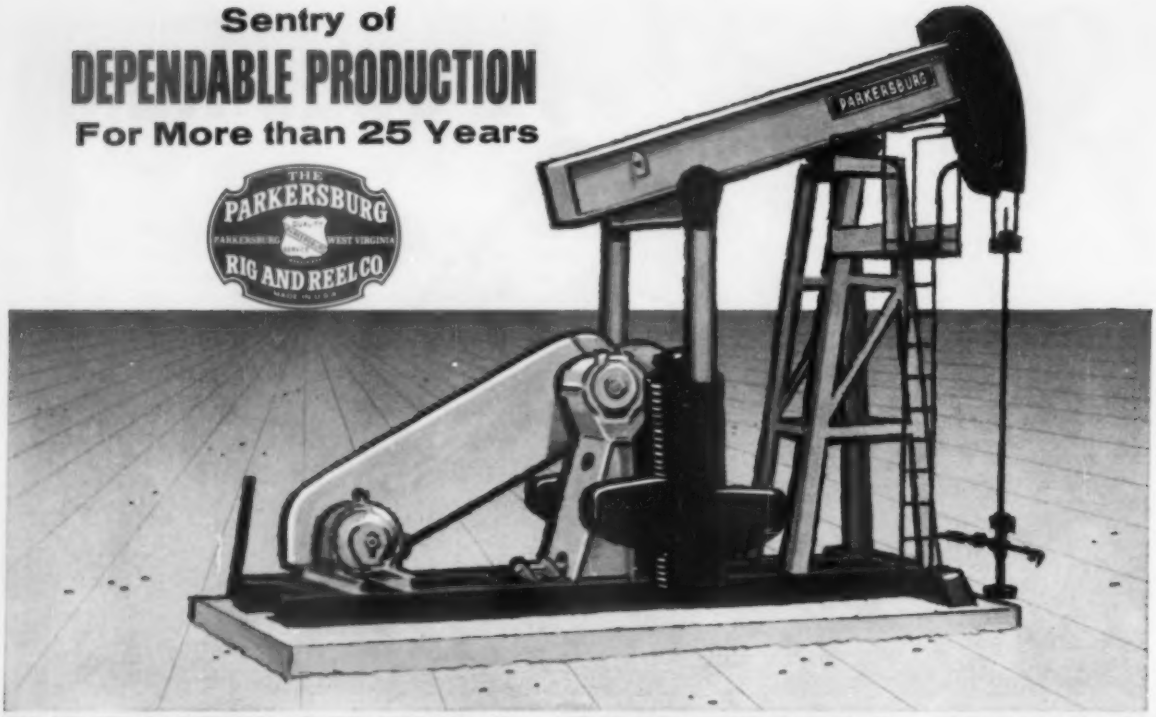
DEPENDABLE PRODUCTION

For More than 25 Years

THE PARKERSBURG RIG AND REEL CO.

PARKERSBURG WEST VIRGINIA

MADE IN U.S.A.



PARKERSBURG PUMPING UNITS

In rain, dust or snow, 24 hours a day, **PARKERSBURG** Pumping Units guard production and protect profits against costly "down time". Just remember . . . dollar for dollar, you can't buy a better pumping unit than one that bears the distinguished name of **PARKERSBURG.**

Your **PARKERSBURG** *Man has complete details— Call him today!*

PARKERSBURG for pumping units of *every* type to meet *every* need.

PARKERSBURG for the most complete line of *wide-base portable units.*

PARKERSBURG for *quality products* at *competitive prices.*

PARKERSBURG for *experience* and *know-how* . . . over 25 years in the pumping unit field.

PARKERSBURG for a *field service* surpassed by none.

PARKERSBURG for the most *prompt delivery* possible, direct to your lease.

THE PARKERSBURG RIG AND REEL CO.

PARKERSBURG WEST VIRGINIA

MADE IN U.S.A.

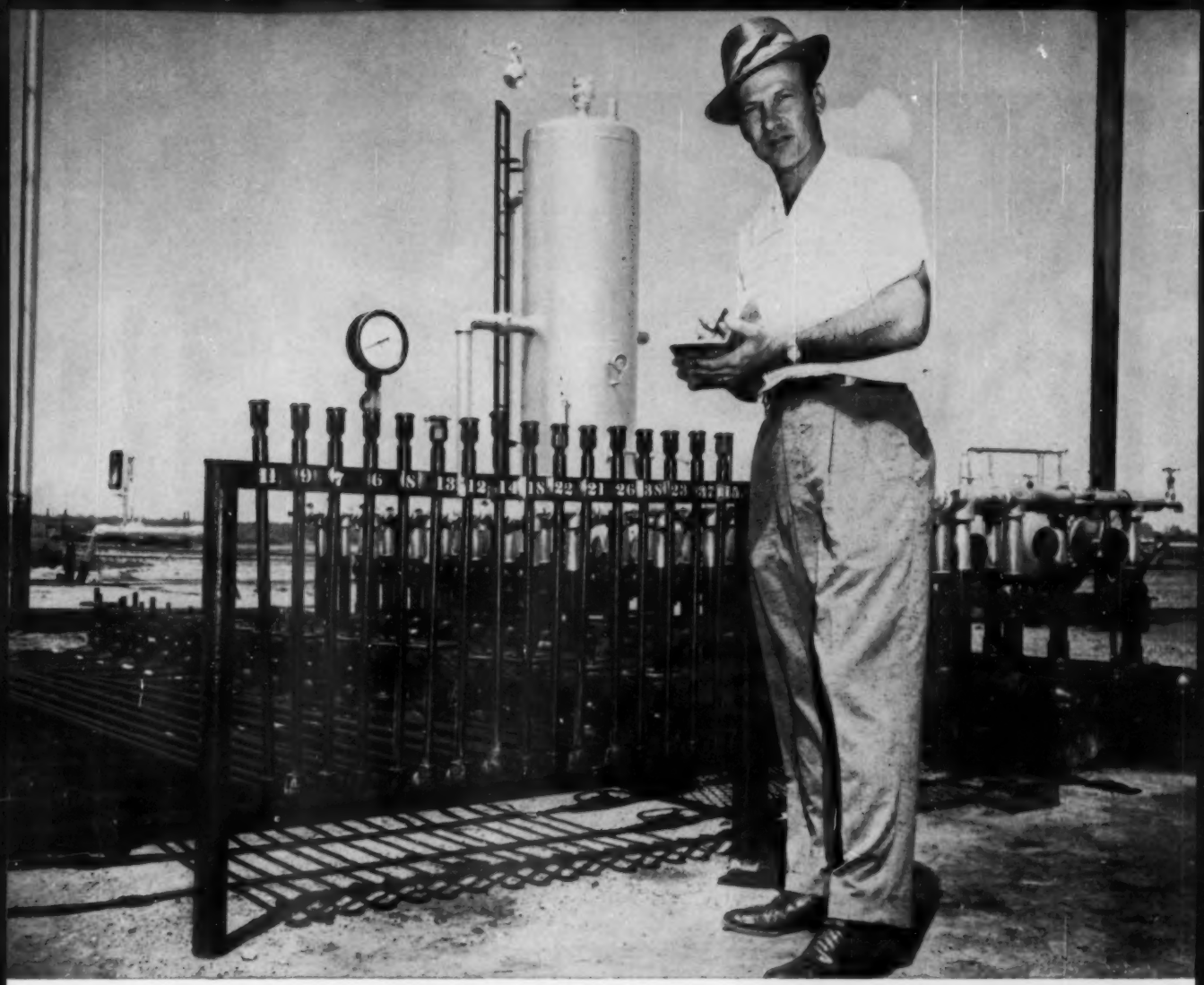
THE PARKERSBURG RIG AND REEL COMPANY

Division of Parkersburg-Aetna Corp.

HOUSTON • TULSA • PARKERSBURG

PESA

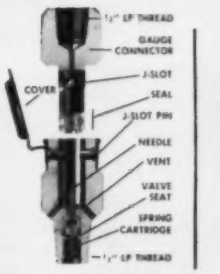
Parkersburg Pumping Units are available through the following supply stores: American Pipe & Supply Co., Beacon Supply Co., Bovaird Supply Co., Canadian Equipment Sales & Service Co., Ltd., C. W. Cotton Supply Co., Franklin Supply Co., Houston Oilfield Material Co., Inc., Industrial Supply Co., Iverson Supply Co., Midland Supply Co., Inc., Mountain Iron and Supply Co., Murray-Brooks, Inc., The Producers Supply & Tool Co., Republic Supply Co., Rodman Supply Co., Superior Iron Works & Supply Co., United Supply & Manufacturing Co., Wilson Supply Co.



You Can Stand In One Spot And Gauge Sixteen Wells . . . With One Pressure Gauge . . . in 10 minutes!

It's no trick, and you can do it. Pictured above is a 16-well manifold at a central lease tank battery. Instead of separate pressure gauges for each well, the manifold is equipped with T-C Gauge Valves. A single pressure gauge, with a T-C Connector attached, is stabbed into each Gauge Valve to obtain a pressure reading. Just insert the connector in the valve, rotate 45 degrees, the valve opens automatically, and that's all.

For individual wells, instead of installing permanent gauges on tubing and casing, many operators are now using T-C Gauge Valves and Connectors. The first cost is lower, there's no gauge breakage—gauge repair costs are eliminated—and since the gauges are not exposed to the elements, you can be sure of accurate pressure readings.

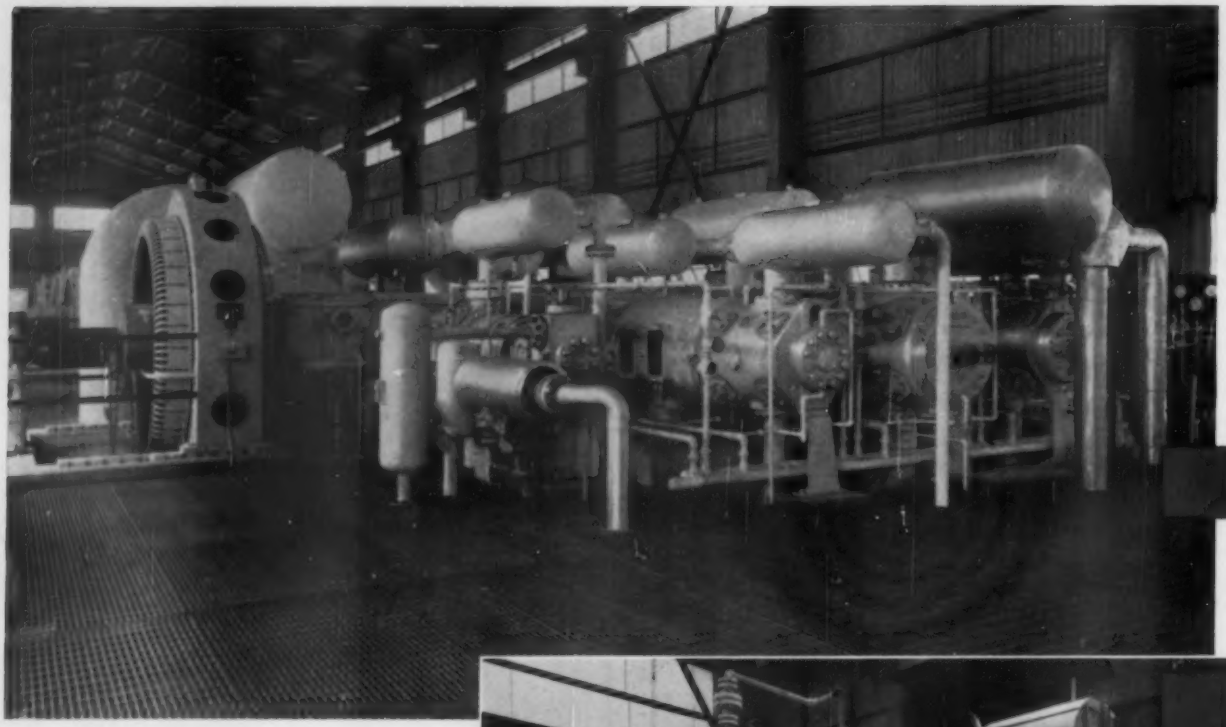


Cross-section view of Gauge Valve and Connector.

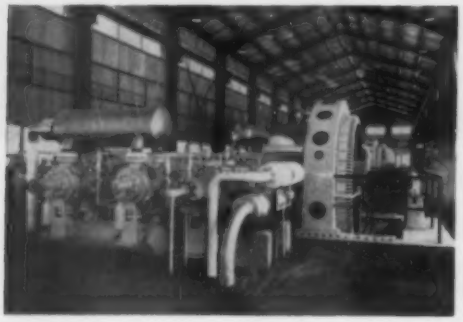
The Gauge Valve and Connector is widely used on Christmas trees.

THORNHILL CRAVER CO.

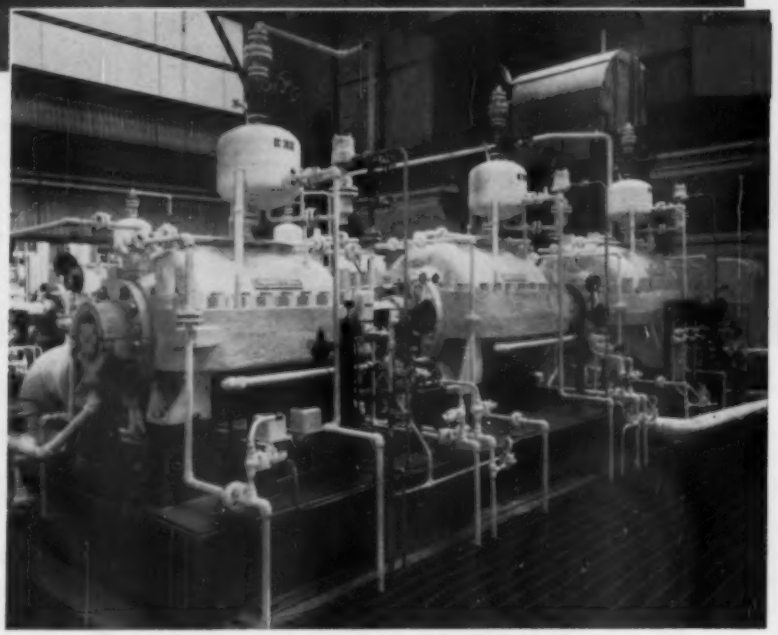
P. O. Box 1184, Houston, Texas



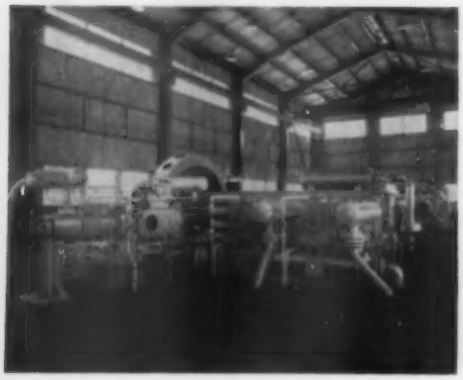
▲ Two 3500-hp HHE compressors in P.C.I. ammonia synthesis plant. Each 12-cylinder unit simultaneously compresses air and nitrogen, each in three stages; ethylene and high-pressure nitrogen, each in two stages; and low-pressure and high-pressure ammonia gas services, each single-stage.



▲ Two 3000-hp HHE hydrogen source gas compressors, each handling waste gases from Platformer, Hydroformer and butadiene plants, as well as ethane and methane residual gases, in eight separate compressor cylinders.

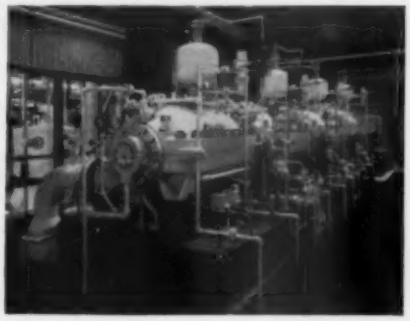


▲ Train of three multi-stage horizontally-split centrifugal units compressing ethylene gas to 396 psi.



◀ Two 4000-hp HHE's compressing ammonia synthesis gas in four stages to 9255 psi.

▶ Train of four multi-stage horizontally-split centrifugals with gas-turbine drive, compressing 10,750 cfm of hydrocarbon feed gas to 525 psi at the P.C.I. ethylene plant.



Ingersoll-Rand compressors and pumps serve all production processes for

PETROLEUM CHEMICALS, INC.

Among the world's most ultra-modern processing plants are the new ammonia synthesis and ethylene units of Petroleum Chemicals, Inc., at Lake Charles, La. The adjacent Calcasieu Chemical Corp. plant, newly-built and operated by P.C.I., is a major producer of ethylene glycol. In all three plants, Ingersoll-Rand equipment plays the lead role in pressurizing and moving the gases and liquids that keep these processes going 24 hours every day.

8 RECIPROCATING COMPRESSORS in Ammonia and Glycol Plants

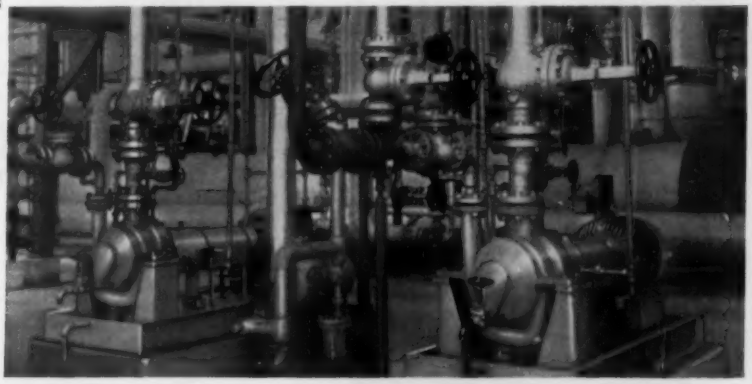
Six multi-stage Ingersoll-Rand electric-driven HHE compressors, totalling 21,000 hp, do all compression jobs in the P.C.I. synthetic ammonia plant. In the Calcasieu Chemical ethylene glycol plant, a four-stage HHE takes 80-psi air from an I-R centrifugal compressor and raises it to 2675 psi. A two-stage PHE compressor handles nitrogen.

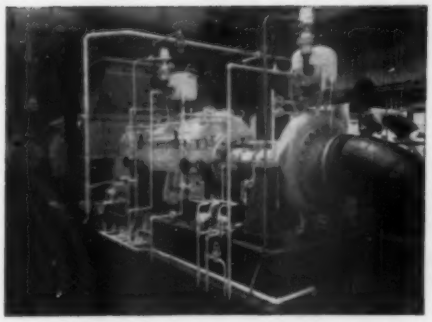
11 CENTRIFUGAL COMPRESSORS in Ethylene and Glycol Plants

Three trains of I-R centrifugal compressors (nine individual units) are at work in the P.C.I. ethylene plant. Each train is driven at approximately 7000 rpm by a 12,500-hp combustion gas turbine. In addition, there are two I-R centrifugals at the Calcasieu glycol plant: a multi-stage compressor discharging 80-psi air to the reciprocating unit mentioned above, and a single-stage blower boosting 8750 cfm of gas to 202 psig.

92 CENTRIFUGAL PUMPS in all three plants

The 92 Ingersoll-Rand pumps at Lake Charles include vertical and horizontal units in single- and multi-stage construction. They serve in all phases of production, handling cooling water, boiler feed water, light hydrocarbons and synthetic ammonia.





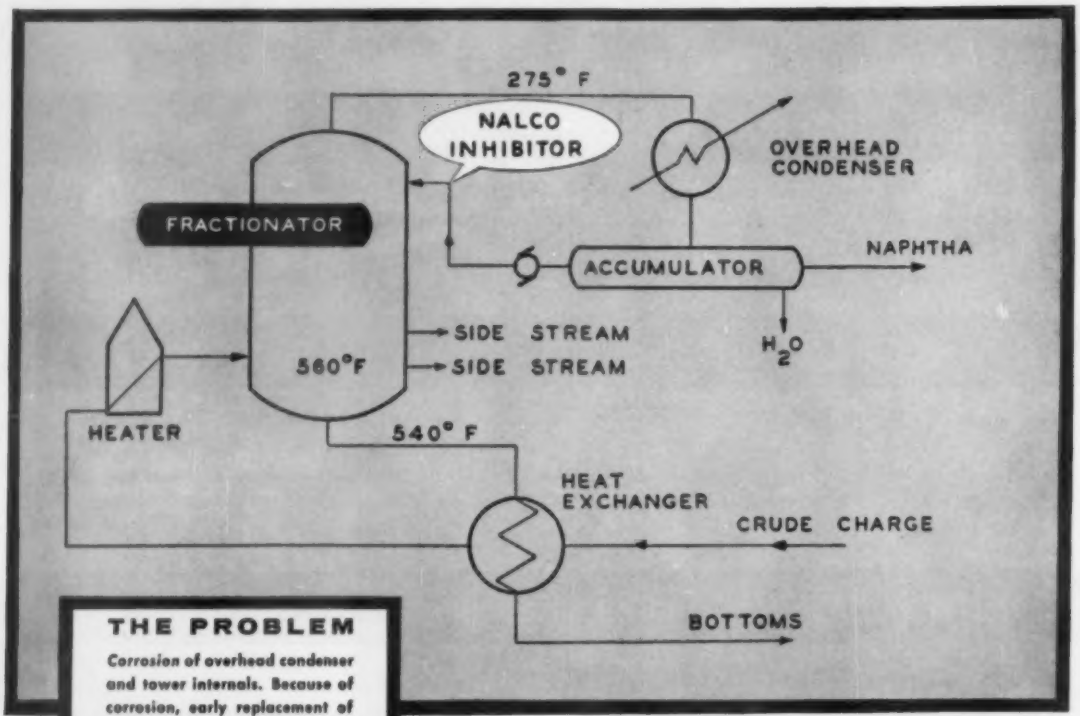
▲ Single-stage and multi-stage centrifugal compressors in tandem, handling propylene at 265 psi discharge.

Ingersoll-Rand

14-907 11 Broadway, New York 4, N.Y.

COMPRESSORS · ENGINES · PUMPS · AIR & ELECTRIC TOOLS
CONDENSERS · VACUUM EQUIPMENT · ROCK DRILLS

HOW *Nalco* INHIBITORS CUT DOWNTIME 74% ...AND SAVED THIS FRACTIONATING TOWER



THE PROBLEM

Corrosion of overhead condenser and tower internals. Because of corrosion, early replacement of the tower was contemplated.

THE TREATMENT

Nalco Corrosion and Fouling Inhibitor applied into overhead reflux.

THE RESULT

In this case only one point of application protected both fractionator and overhead equipment. Iron in accumulator water brought below 0.5 ppm as compared to previous 100-150 ppm. Corrosion and plugging stopped, tower saved, and downtime for cleaning reduced by 74%.

EFFECTIVE Nalco corrosion control is very low-cost protection. For example, this refinery not only avoided the cost of a new tower, but cleaner tower internals actually resulted in better fractionation and higher quality products. If you would like further facts on Nalco Corrosion and Fouling Inhibitors, ask your Nalco Representative or write direct.

NATIONAL ALUMINATE CORPORATION

6242 West 66th Place • Chicago 38, Illinois
Telephone: POrtsmouth 7-7240
CANADA: Alchem Limited, Burlington, Ontario
NORTHWESTERN UNITED STATES, HAWAII and ALASKA
The Flox Company, Inc., Minneapolis 3, Minnesota
ITALY: Nalco Italiana, S.p.A.
WEST GERMANY: Deutsche Nalco-Chemie GmbH
SPAIN: Nalco Espanola, S.A.

THE *Nalco*® SYSTEM ...SERVING INDUSTRY THROUGH PRACTICAL APPLIED SCIENCE

Nalco CHEMICALS

YOU GET PUMPING ECONOMY WITH CONTINENTAL-EMSCO UNIT PUMPERS

Engineered..Not Just Built

Continental-Emsco's wide range of unit pumpers makes it possible to match any well *right on the nose* with the type and size unit best suited for low-cost, efficient pumping. This means less initial investment with a unit *sized for the job.* C-E unit pumpers are designed to be accurately and easily counterbalanced for additional saving of electric or fuel costs . . less wear of gears, belts, bearings and well equipment.

Pitman design and use of roller bearings lower starting loads by reducing breakaway friction . . a big design feature for keeping power cost low when using electric motors.

Get your complete production package from Continental-Emsco . . unit pumpers . . engines . . motors . . controls . . rods . . subsurface pumps. Each matched with the other for pumping harmony at minimum cost.

For Service that Sings..Equipment that Hums..Go..

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide

PT802

CONTINENTAL-EMSCO COMPANY • A Division of The Youngstown Sheet and Tube Company • General Offices: Dallas, Texas
Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited • General Offices: Calgary, Alberta, Canada
Continental-Emsco Company C. A., Caracas, Venezuela • Plants: Houston and Garland, Texas; St. Albans, Herts., England • Representatives in All Principal Oil Fields of the World

T F

Precision Press Forgings (as well as Hammer Forgings and Extrusions) are made in quantity on a production basis as missile, rocket and engine components, heavy machinery parts, etc. This 64¾" OD x 1½" wall thickness press-forged stainless steel part is a Heat Sink for a long range missile.

TAYLOR

This 42" OD x 16" long Stainless Steel Jet Engine Turbine Case is representative of products formed by Taylor Forge ring rolling methods. Seamless rings are made in sizes to 120" OD with practically any required section.

Forged Headers with contoured outlets, made with any required outlet arrangement, are widely used for valve settings, gas compressor station manifolds, scraper traps, refinery charge heater headers, and many other applications in gas, oil and process piping. They are also made in heavy wall thicknesses for high pressure-temperature central power station service.

Electric Fusion Welded Pipe is made in sizes from 14" OD to 96" OD with wall thicknesses to 1.531", and in a variety of materials (including stainless and alloy steels). This pipe offers many opportunities for substantial economies, particularly in high pressure-temperature services and also in pipeline river crossings and other applications involving special design requirements. Pipe pictured is 16" OD x 1" wall thickness and is stainless steel.

SERVING INDUSTRY with many essential products

FORGE

Traditionally Dependable

Perhaps you think of Taylor Forge only as a maker of highest quality Welding Fittings and Forged Flanges—and certainly they are most important lines with us. But Taylor Forge is also an outstanding producer of many other less widely known though equally essential products.

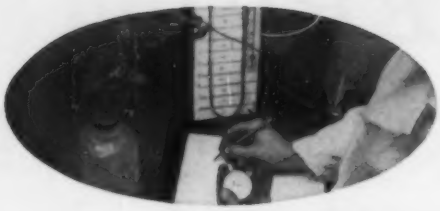
The few examples pictured here are representative of the many diverse parts made by Taylor Forge to serve American Industry. One thing they have in common is the dependability, the integrity, that has always been associated with the name TAYLOR FORGE.

Taylor Forge & Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois
Plants at: Carnegie, Pa., Gary, Ind., Houston, Texas, Fontana, Calif., Hamilton, Ont., Canada
District Sales Offices: New York, Boston, Philadelphia, Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles, San Francisco, Seattle, Toronto, Calgary, Montreal.

Taylor Forge was America's first and is still the foremost manufacturer of Welding Necks, Nozzles, Large Diameter Flanges and similar boiler, heat exchanger and other pressure vessel components. Such parts are made in any size and material for any service condition.

Spiral-Weld Pipe, our original product, (first made as spiral riveted pipe nearly 60 years ago), remains to this day a major item and its use continues to expand. Its money saving features are widely recognized in services such as gas gathering lines; gas, oil and water well casing; irrigation pipe; water piping in sand, gravel and mining operations; and in fact, wherever the use of light weight pipe is indicated. It is also widely used as pipe piling.



A look at today...and a glimpse

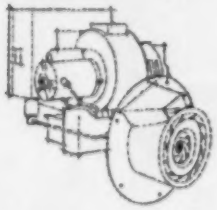
Armour Chemicals for Refined Products

Where they work today

Fuel oils—gasolines—asphalts. Every major area in refining can profit from Armour Chemicals. There is a variety of economical, oil soluble, cationic chemicals for each special job. Some function as additives for direct use in finished products; others are ideal as corrosion inhibitors during processing; still others perform as versatile chemical intermediates in the making of new products.

Fuel Oil Additives

The Armolads® are Armour's series of special furnace oil additives. They have been proved efficient at costs of less than 1¢/bbl.—making them the most economical fuel oil additives now being offered refineries.



All the Armolads are ashless additives. They are of the inhibitor-dispersant type and will impart corrosion inhibiting properties.

Armolads are fatty amine derivatives and are 100% active. It has been proven that the Armolads will effectively stabilize oil against insoluble gum formation and color degradation, and improve filterability without promoting emulsions in furnace oils from various crude sources.

Physical characteristics

	Pour Point	Specific Gravity
Armolad F22	28°F	0.857 at 79°F
Armolad F24	64°F	0.856 at 79°F
Armolad F25	62°F	0.835 at 84°F
Armolad F26	38°F	0.822 at 79°F
Armolad F28	52°F	0.840 at 79°F
Armolad F20	Melt Pt (approx) 115°F	0.797 at 138°F

Comparison tests (Mid-East stock)

	12 months ambient storage Mg/liter	DuPont's 13 week test Mg/liter	UltraViolet light test Mg/liter
Control	134	36.0	64.5
Armolad F22	68	4.0	20.5
Armolad F20	74	4.0	23.5
Competitor M	139	102.5	23.5

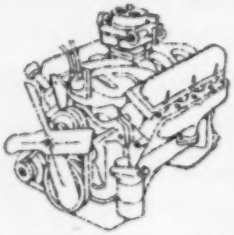
All crude stocks—Mid-Continent, Mid-East, West Texas, and Venezuelan—can be improved by one of the Armolads.

Armour will recommend a specific Armolad for the crude oil you're processing and help you determine the optimum concentration needed to do a satisfactory job economically.

For more information on the entire series of Armolads, check "A" in the coupon.

Gasolines

Armour Chemical offers refiners several chemicals that have found wide acceptance as gasoline additives. Both the Armeens® and Duomeens® are used as anti-stalling additives.



The Armeens . . . $R(NH_2)$—are high molecular weight aliphatic amines. They are cationic surface active agents and have the ability to change surfaces from hydrophilic to hydrophobic.

The Duomeens . . . $R(NH)CH_2CH_2CH_2(NH_2)$ . . . are Armour's series of N-alkyl trimethylene diamines. They are prepared according to the following reaction:

$$RNH_2 + CH_2{=}CH_2\ C{\equiv}N \xrightarrow{H_2} RNHCH_2CH_2CH_2NH_2$$

The Armeens and Duomeens are excellent corrosion inhibitors. Both can be reacted with various organic or inorganic acids to give you additional versatile additives which will impart the following characteristics: (1) excellent detergency, (2) improved thermal stability, (3) increased lubricity.

For more information on the Armeens and Duomeens as they are applied in refinery applications, check "B" in the coupon.

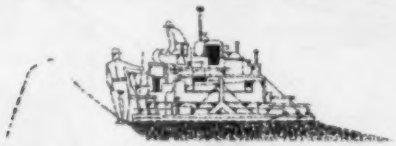
Asphalts

If you have an additive requirement when marketing asphalt, it will profit you to know more about the Redicotes® and Duomeen T. Armour's chemicals for this area of refining are designed to help you make treated asphalt that will pass difficult state stripping tests. They're effective at concentrations as low as 0.2%. Even at such a low concentration they im-

# of tomorrow

from Armour Chemical

prove adhesion of asphalt to damp or wet aggregates, permitting contractors and highway departments—your customers—to extend their paving season.



Many asphalt plants and refineries are using Duomeen T or Ethoduomeen T/13 as a starting material for making their own asphalt adhesion agents. Let Armour's technical staff assist you in formulating your own anti-stripping additive.

Chemical-physical properties of Redicotes

(Salts of Polyamines derived from tallow)

Redicote	Pour Point	Typical SSF Viscosity	Typical Sp. Gr. @ 20°C	Per Cent Active
76	120°F	25 (@ 140°F)	0.859	100
77	110°F	45 (@ 122°F)	0.875	100
79-S	105°F	40 (@ 122°F)	0.894	100
80-S	60°F	127 (@ 122°F)	0.940	100

For additional data, check "C" in the coupon.

Where Armour Chemicals for refineries will work tomorrow

In fuel oils. More efficient dispersants and stabilizers for the heavier fuel oils are being developed by Armour for the refining industry. Results have been encouraging and will be announced in the near future.

In gasolines. Armour is currently developing new poly-functional materials to make gasoline engines run cleaner. Work is progressing with additives to improve engine performance all year-round.

In emulsion-grade asphalts. Armour has new information available on cationic emulsifiers that are insensitive to hard water; that promote better adhesion on all types of aggregate; and that can be used at economical concentrations with asphalt from any crude source.
For laboratory progress report, check "D" in coupon.

Find out how Armour's chemicals for refineries can work for you. Our chemical specialists will help you utilize the right additive or basic chemical for your products or special situation. Write or call Armour today.

NEWS NOTES

London, England. A new, improved corrosion inhibitor has been developed for application in both refinery streams and in metal working oils. The inhibitor is formed by reacting an Armour diamine with wool grease olein.

•

Hamburg, Germany. Difficult performance specifications now required by growing industrial demands have been met by incorporating an Armour amine into crankcase lubricants and an Armour diamine into diesel oils.

•

Cleveland. Increased die life, cleaner surfaces, the elimination of breaks, and the stopping of chattering is being accomplished by oil soluble diamine salts at one of the large tube manufacturers in this area.

•

Wilmington, South Carolina. Within the past month, new asphalt test roads have been laid here from finely dispersed, stable cationic emulsions. The emulsions were prepared with Armour's cationic surfactants.

•

San Francisco. Drum corrosion is being effectively combatted by an Armour diamine at concentrations of ½ to 1% in a product consisting of phenolic and chlorinated chemical dissolved in kerosene.

How can Armour Chemicals help you?

Check here for more information on your field of interest. ☐ A ☐ B ☐ C ☐ D

Send sample and more information for this application:

_____

_____

_____

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

(Sample offer limited to North American Continent)

Leader In Progressive Fatty Acid Chemistry

ARMOUR CHEMICAL DIVISION

1355 West 31st Street • Chicago 9, Illinois

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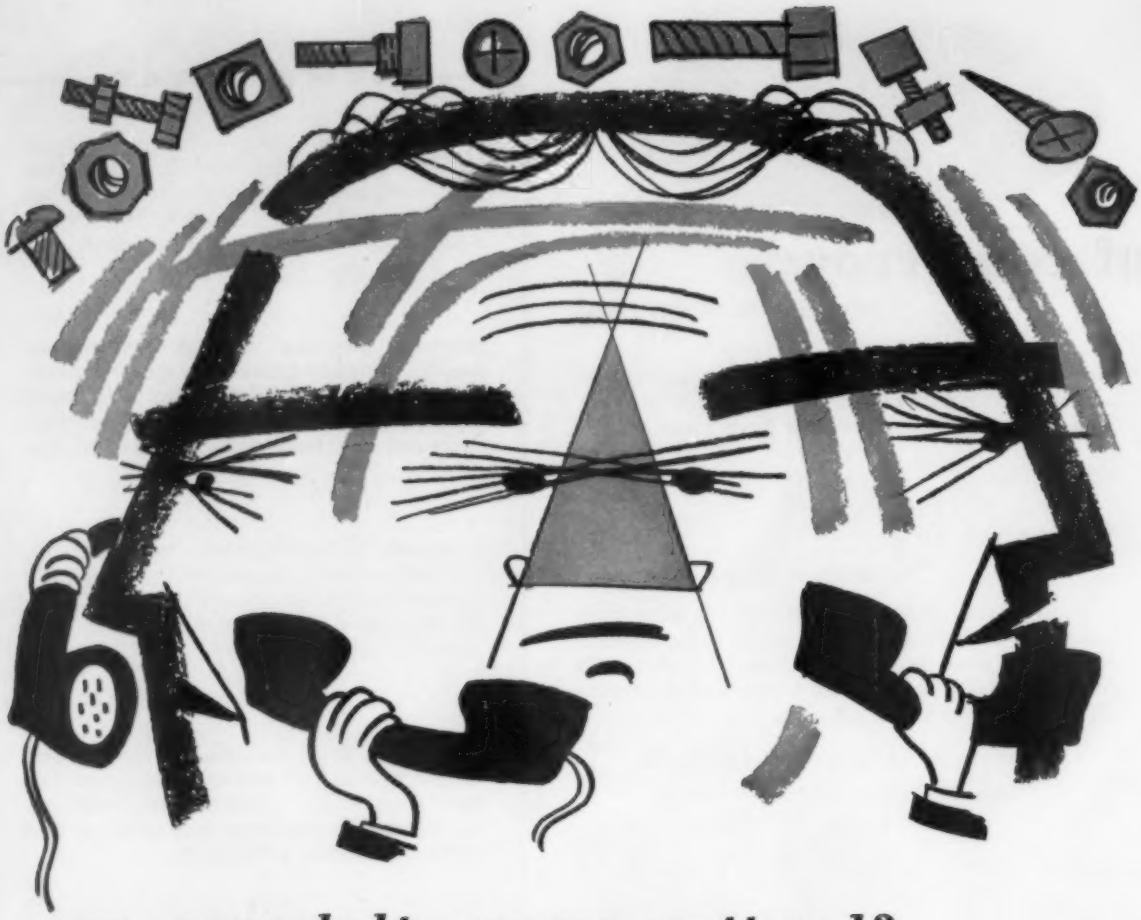


are your bolt sources scattered?

Buying bolts from scattered sources can waste a lot of time. Slow down production. Cause all kinds of headaches and delays.

There's a better way: Get all your bolts from Sheffield. You'll have a *single source* for a *full line.* Thousands of standard and special bolts. Or bolts made to your specifications in record time.

You get quick shipment because Sheffield has one of the world's largest integrated bolt plants. You get the advice and technical help of bolt specialists. And with every bolt you get quality that's rigidly controlled from furnace to finished product.

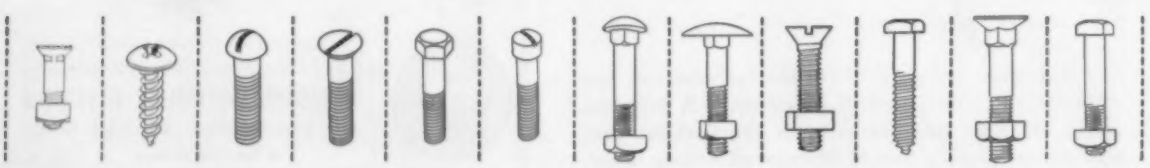
Anyway you look at it, you're ahead when you make Sheffield your single source for every bolt need. Call your Sheffield Man for all the facts.

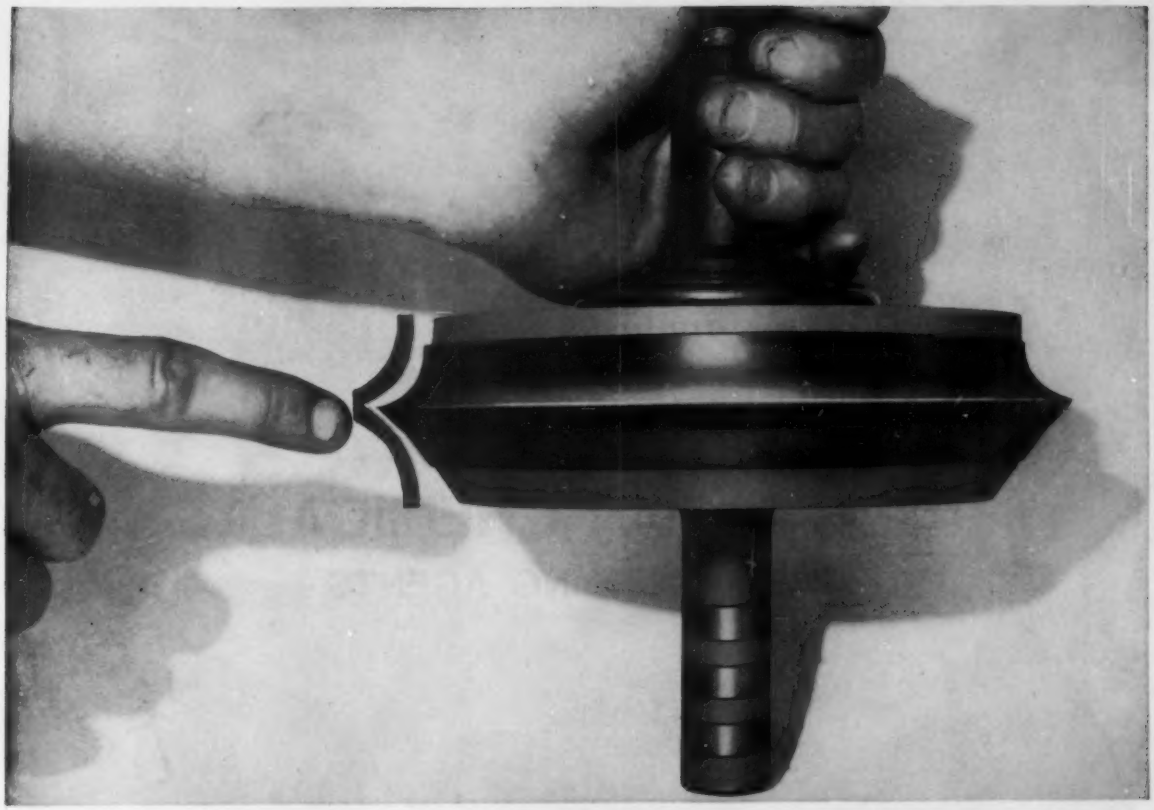
Bolt Makers Since 1888

SHEFFIELD DIVISION

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products





This AMERICAN IRON Double-Angle Insert is Outlasting ALL Others!

EVERY DRILLER who is using our new, exclusive double-angle inserts in American Iron Valve & Seat installations is reaping the benefits of these advantages:

- Lost circulation material is handled better.
- Perfect clearwater prime.
- More cushion is provided for valve impact on rapid close under high pressures.
- Made of finest materials, formulated and specified by our Research Laboratory, for longer-lasting more-effective service in your pumps!

For greater economy Order AMERICAN IRON Slush Pump Valves & Seats with the exclusive inserts!

Available through your Supply Store

Another AMF Product PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

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Whatever your applications in natural gas sweetening, refinery stream sweetening, sulfur recovery, gas dehydration, and carbon dioxide absorption . . . Jefferson Chemical has the right products in the special grades and quantity you desire.

You may utilize the most convenient size shipment and carrier for your production and storage needs . . . single-product or compartmented tank cars of 4,000- to 10,000-gallon capacity, single-product or compartmented tank wagons of 1,000 to 4,000 gallons, or 55-gallon drums.

Combine these high purity chemicals and prompt, accurate shipments with Jefferson's experience and complete willingness to render every possible technical assistance, and you have a first-rate source for your "Gas-Scrubbing" needs. Ask your Jefferson man at 1121 Walker Avenue, Houston 2, Texas.

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Ethylene Oxide, Glycols, Dichloride • Ethanolamines • Morpholine • Piperazine
Polyethylene Glycols • Nonyl Phenol • SURFONIC® Surface-Active Agents
Ethylene Carbonate and Propylene Carbonate • Caustic Potash • Caustic Soda
Soda Ash • Sodium Bicarbonate

Essential Chemicals From Hydrocarbon Sources

118

SAVE money

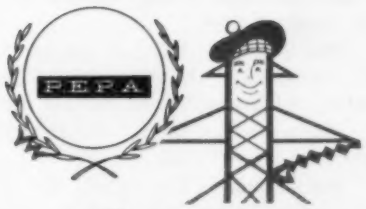
SAVE maintenance

SAVE with Electrical Developments

SAVE manpower

New ideas with Electric Power such as this submerged aerator provides multi-savings

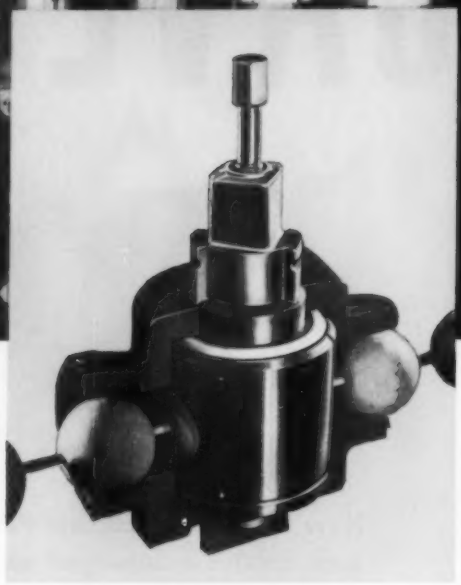
Through use of the 50HP 440 Volt Motor, above, operating a blower for the submerged aerator, shown right, this user of Utility Power achieved more positive aeration, saved investment of large open lined pond and saved on water loss by eliminating spray action. This is typical of the adaptability and savings of low-cost Electric Power. For more information on how you can save call your local Utility Electric Power Company or write us.



Purchased Electric Power . . saves money, manpower, maintenance and serves you better automatically

Petroleum Electric Power Association

P.O. BOX 35006, DALLAS 35, TEXAS



W-K-M's *Creative Engineering* has solved your plug valve problem!

Users of ACF Lubricated Plug Valves are enthusiastic about the performance of their valves.

Whatever the service . . . whether the valves are small or large . . . whatever the lading . . . ACF Lubricated Plug Valves handle the most difficult valve jobs.

For example: The shearing action of the cylindrical plug cuts through tough, stringy slurries clean as a knife—no stoppages, constant flow.

For example: You can see excess lubricant as it escapes around the neck of the plug—no build-up of excessive lubricant pressure; no lubricant forced into the line.

For example: Special design requires a minimum amount of lubricant for servicing.

For example: The valves may be installed in any position, and they fit into the smallest possible space.

Specify ACF when your job calls for plug valves. They'll give you dependable performance, long life and economical operation.

acf®

Lubricated Plug Valves

with round port, full pipe area

This is the valve for heavy fluids and ladings. When open, the round port becomes an exact continuation of the pipe. There is no change in velocity, area, direction or cross-section of the lading. There are no pockets to trap the lading, and seating surfaces are sealed away from contact with the fluid flow.

• • •

W-K-M provides a complete line of specially formulated lubricants for ACF Lubricated Plug Valves. Write for Catalog 800 for ACF lubricant recommendations.

WRITE FOR CATALOG 400

W-K-M

DIVISION OF acf INDUSTRIES
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P. O. BOX 2117, HOUSTON, TEXAS

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Let your plans include the specialized knowledge and resources of the nation's Pioneer Oil Bank.

84th Year of Dependable Service

FIRST NATIONAL BANK IN DALLAS

Member Federal Deposit Insurance Corporation

STOP

the confusion of

CO-CHANNEL

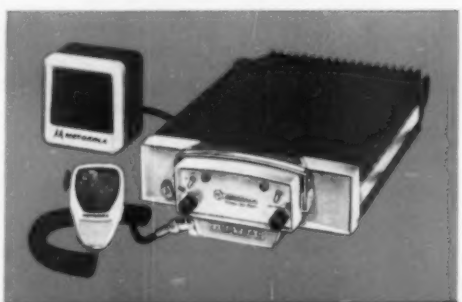
messages

with PRIVATE-LINE RADIO
only messages with your own signal code are heard by your drivers

Now you can get off the "party line" with Motorola PRIVATE-LINE radio—the new kind of 2-way radio that shuts out the constant stream of annoying messages from others who share your channel.

Watch driver and dispatcher fatigue go *down* and all-around efficiency go *up*. There are fewer repeats, fewer missed messages, fewer mistakes . . . benefits that rapidly translate into improved customer service, greater productivity, and greater profits for you.

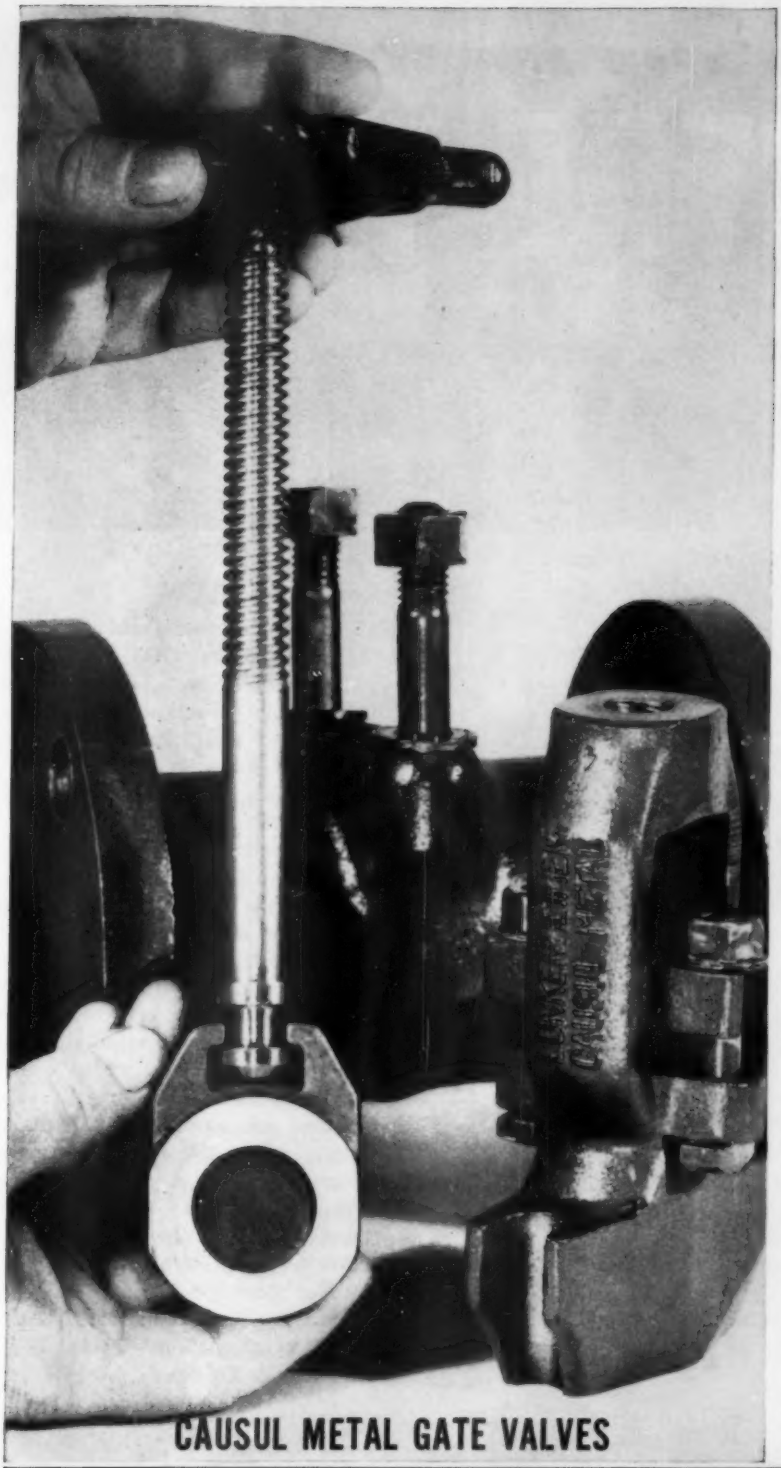
Put the added dependability of Motorola PRIVATE-LINE radio to work for you—as more and more users are doing. Write or phone for complete information.



PRIVATE-LINE operation is now available in the new MOTRAC radio with completely transistorized power supply and receiver. You get greater reliability and save on gasoline, engine wear and batteries.

MOTOROLA *PRIVATE-LINE 2-WAY RADIO*

Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Illinois, A Subsidiary of Motorola Inc.



CAUSUL METAL GATE VALVES

"HIGH ALLOY" Performance at Iron Valve Costs

CAUSUL METAL GATE VALVES *by* LUNKENHEIMER

"Causul" Metal Valves offer *balanced* corrosion-resistance, yet cost far less than expensive high alloy valves. "Causul" Metal bodies and bonnets are teamed with Stainless Steel or Monel seats, discs, and stems to give maximum resistance to corrosion at the lowest possible cost. Heavy, thick body walls provide extra strength and durability. For full details on the maintenance-saving features of "Causul" Metal Valves, call the Lunkenheimer Distributor in your area. He will be glad to show you how you can keep valve maintenance costs down without investing in premium priced high alloy valves. . . . Or write The Lunkenheimer Co., Cincinnati 14, Ohio.

L-5884

LUNKENHEIMER QUALITY

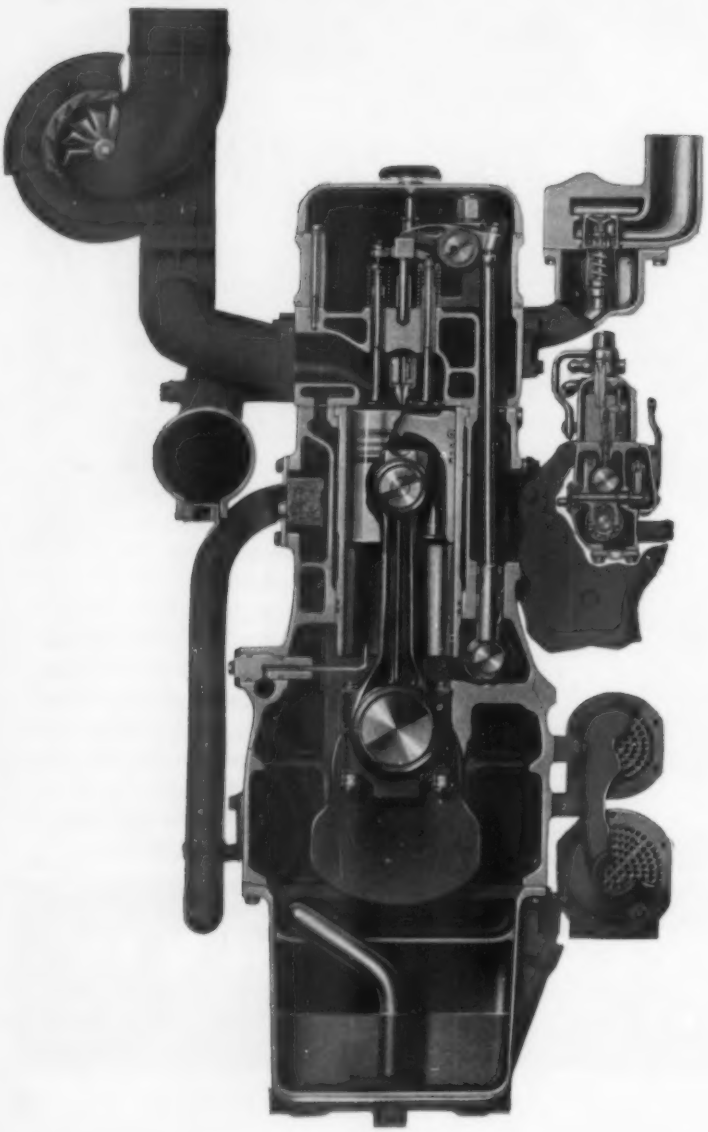
LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

NOW FOR THE FIRST TIME

NEW 385

INTERNATIONAL® UDT -



Here's the all-new direct start 385 max. hp International UDT-817—a compact, heavy-duty 4-cycle, 6-cylinder engine thoroughly proven in six years of development and testing—backed by 26 years of experience in manufacturing and selling over 400,000 heavy-duty diesel engines.

Designed for versatile application in a wide variety of rugged oil field applications, the UDT-817 answers the demand for dependable high power and lower cost operation on compressors, pumps, and on drill rigs.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

For more specific information or application assistance, merely call your nearby International Power Unit Distributor or Dealer.

BRIEF SPECIFICATIONS

Type	4-cycle turbocharged
Bore and Stroke	5⅜ x 6"
Number of Cylinders	6
Displacement	817 cu. in.
Max. hp.	385 @ 2100 rpm
RATED HP	375 @ 2100 rpm
Max. Torque	1,040 lbs. ft. @ 1400 rpm
Compression Ratio	16:1
Weight	3,540 lb.
Lbs. per max. hp	9.2
Length, fan to flywheel	61½"
Height	56½"
Width	39½"
Flywheel housing SAE	No. 1

hp.
817

FEATURES THAT PROVIDE DEPENDABLE, ECONOMICAL OIL FIELD POWER

- Fast direct starts with 24-volt electrical system.
- Direct injection of fuel under pressures to 20,000 psi by individual camshaft actuated multi-orifice injectors.
- Exclusive IH twin plunger metering pump directs equal and precise amounts of fuel to each injector in proper firing order according to load and speed demands.
- Turbocharger puts waste energy in exhaust gases to work for higher power output and lower fuel consumption.
- Dual intake and exhaust valves for free breathing efficiency.
- Positive valve rotators keep valve seats free of deposits.
- Aluminum alloy pistons working in replaceable wet cylinder sleeves with velocity swirl flow water cooling on outside, jet oil cooling on inside, for long life operating temperatures.
- Fully counterbalanced Tocco-hardened crankshaft with seven big main bearings and torsional vibration damper for smooth, dependable high power output.

International® Construction Equipment

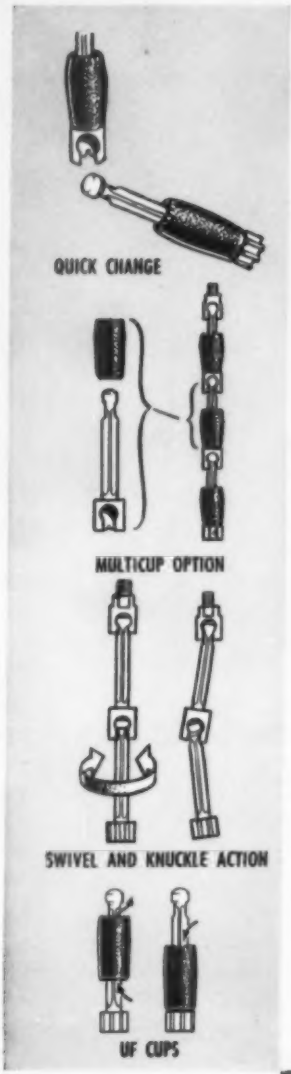
International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

CUT COSTS..SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line . . you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously . . but that's not all . .

MULTICUP OPTION — Add a cup and upper mandrel . . as many as desired. No need to carry several different swabs . . no time lost in changing swabs. There are only five parts in a two cup swab . . sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION—You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life . . made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position . . sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads . . flexible enough for light loads . . small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

THE

GUIBERSON

CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

Equipped to drill a depth of 24,000 feet with all crown block sheaves on TIMKEN® bearings

THIS rig in Oklahoma is equipped to drill a depth of 24,000 ft.! The mast is a Lee C. Moore 142′ Cantilever, with a gross capacity of 1,025,000 lbs. And for all crown block sheaves, Lee C. Moore used Timken® tapered roller bearings to keep sheaves properly aligned and turning easily, reduce maintenance.

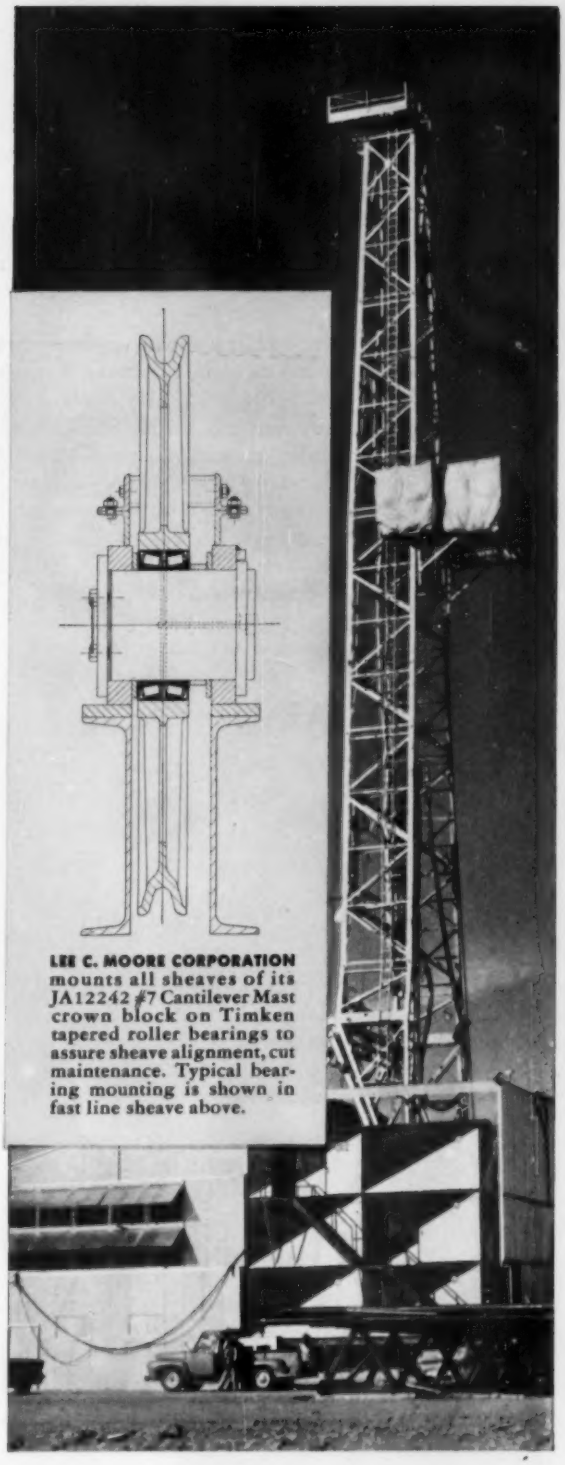
The tapered construction of Timken bearings lets them take the heavy radial and thrust loads of deep drilling. And the full-line contact between rollers and races gives Timken bearings *extra* load-carrying capacity. Sheaves *stay* aligned and turn easier under constant, heavy loads. Drilling goes steadier.

Timken bearing rollers and races are case-carburized to produce hard, wear-resistant surfaces over tough, shock-resistant cores. They last longer, help parts work better, reduce maintenance. And Timken bearings are geometrically designed and precision-made to roll true. Friction is virtually eliminated. They *roll* the loads. We even make our own electric furnace fine alloy steel to be sure it's the finest. We're America's only bearing maker that takes this extra step to control quality.

Timken bearings make machines better. And better machines do better work, give you more for your money. That's Better-ness. Look for its symbol—the trademark "TIMKEN" on the bearings for the machines you build or buy. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

See us at the INTERNATIONAL PETROLEUM EXPOSITION, Oklahoma Building, Booths 139-142, Tulsa, Oklahoma. May 14-23, 1959.



LEE C. MOORE CORPORATION mounts all sheaves of its JA12242 #7 Cantilever Mast crown block on Timken tapered roller bearings to assure sheave alignment, cut maintenance. Typical bearing mounting is shown in fast line sheave above.

BETTER-ness rolls on **TIMKEN®** tapered roller bearings

". . . supply stores have not faltered in giving good service"

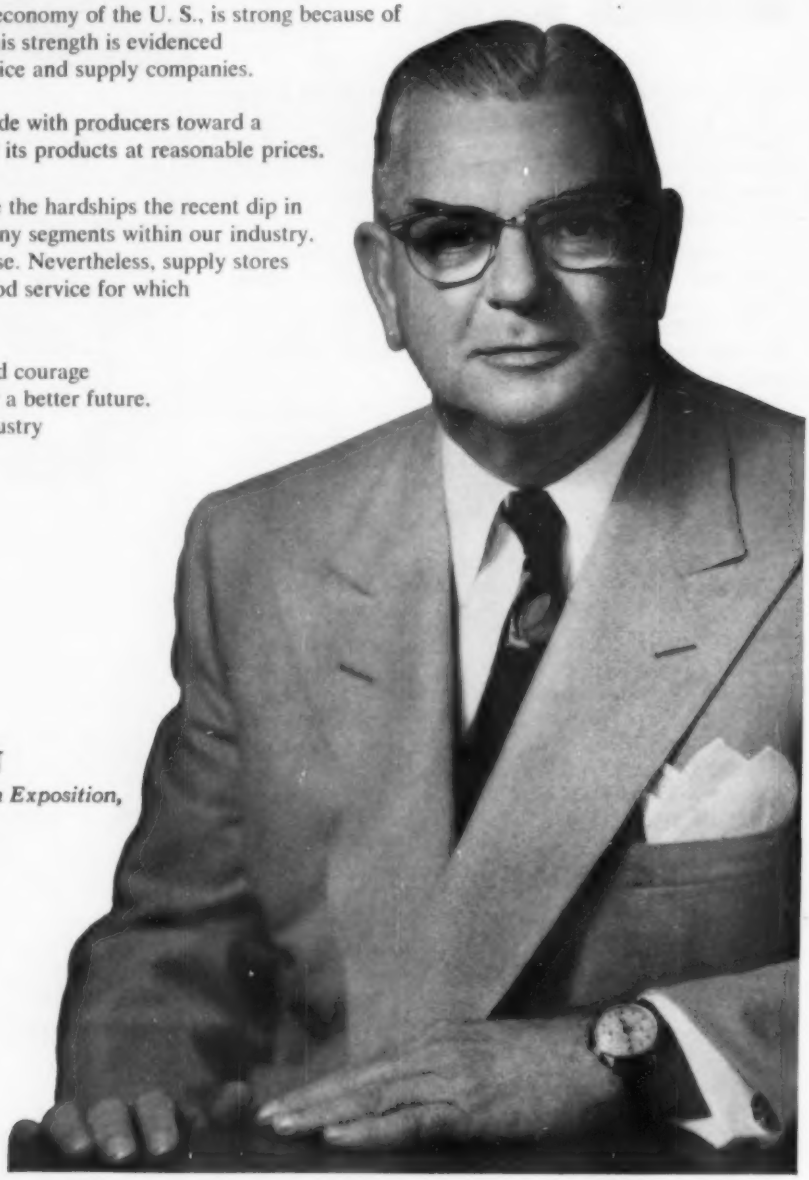
"There are Prophets of Gloom who continuously cry that 'We are running out of oil.' I am not one of them because I am firmly convinced that America will not run out of oil in the foreseeable future—provided our system of private enterprise is allowed to take its natural course.

"The oil industry, like the overall economy of the U. S., is strong because of such a system. One example of this strength is evidenced by the industry's equipment, service and supply companies.

"Those companies strive side by side with producers toward a common goal: Adequate oil and its products at reasonable prices.

"All of us in the industry recognize the hardships the recent dip in the oil activity has worked on many segments within our industry. The supply industry is one of these. Nevertheless, supply stores have not faltered in giving the good service for which they long have been noted.

"This is the type of doggedness and courage that licks problems and builds for a better future. And, certainly, the petroleum industry has a great future."



MR. W. K. WARREN

President, International Petroleum Exposition,
Chairman of the Board and
Chief Executive Officer,
Warren Petroleum Corporation

P.E.S.A.*

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

National Tank Equipment is typical of the line of quality products available through our Venezuela stores. National Supply is the exclusive export distributor for National Tank.

This is NATIONAL SUPPLY in Venezuela

In our Anaco, Venezuela store is one of the most complete inventories of National Tank equipment outside the United States. Venezuela is good oil country—for us, for National Tank and for any other manufacturers whose quality products we sell in our four stores there. Why? National Supply Store customers know they can count on these benefits *wherever* they buy from us: ample stocks, quality brands, fair prices, fast service. You can prove it for yourself at the National Supply Store nearest you.

On the next pages:

the best production equipment you can buy!

NATIONAL
NATIONAL
NATIONAL
NATIONAL
NATIONAL
NATIONAL
NATIONAL

Check these NATIONAL features before you buy any pumper!

Some of these features are listed as "extras" and "special features" in other units. All of them are *standards* in the line of National Pumping Units. Check them now, and you'll see why the best pumper investment for lowest operating cost is National.

ACCURATE COUNTERBALANCING—Because of the geometric and concentric design of cranks and counterweights, National Pumpers allow the best counterbalance—at a leading or lagging condition *as well as at mid-stroke*—you can obtain today. Counterweights can be quickly and safely adjusted by one man, in a method that's far superior to slab adding or subtracting systems.

TWO-DIRECTION GEAR REDUCERS—National gear reducers meet or exceed all API specs, and can be rotated in either direction. This permits more latitude on prime mover placement, and extends the life of the reduction unit. Other units without proper geometric design or with one-direction lube systems can't use reverse rotation for these benefits.

GROUND LEVEL LUBRICATION—This is a desirable *standard* safety and convenience feature in all National Pumpers for which you pay no extra charge.

HINGED ARC HANGER—National's arc hanger has a hinge which allows you to fold it back for unhindered well servicing. It also has self-adjusting features which prevent side loading, polish rod bending and excessive wear on stuffing box packing. Many other pumpers lack these practical, economical features.

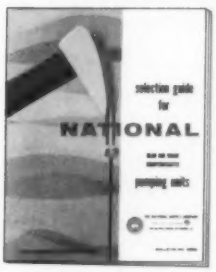
OUTSTANDING CRANK DESIGN—The gear reducer is placed on sub-base on crank-counterweighted National models. This places it at a height which prevents the weights from traveling below the unit base, and thus eliminates side pit digging for proper clearance. Split cranks are used for easy field removal and replacement—no solid cranks to cause extended down time, transportation and machine shop expenses.

FRICTIONLESS BEARINGS—National provides the best frictionless bearings for the loads and motions involved in pumping unit operation—straight or tapered style roller bearings on all fully rotating shafts, and proven needle type bearings at points where limited or oscillating motions are present. These bearing selections mean minimum horsepower losses through the unit and greatly increased bearing life.

BEST DUST SEALS—National Pumpers have dust excluders on all bearings to improve the life of oil seals and bearings. Dust seals on shafts rotate with, but do not touch, the shafts, and are extremely efficient.

UNMATCHED STABILITY—National Pumping Units have wide spacing of the samson post's four legs plus cross bracing. This makes them far less susceptible to twisting or stressing due to improper unit setting than other units of small leg spread, three-leg construction or without cross bracing.

No need to compromise on pumper size and rating!



This handy new selection guide tells all the factors to consider when buying a pumping unit. It contains examples, charts and nomenclature details. Pick up a free copy at any National Supply Store.

SHOW TIME IS GO TIME!

ATTEND THE

I.P.E.

TULSA • MAY 14-23

These 10 Type E National Pumpers are in operation on a California lease. National Pumpers are available in 13 basic sizes, with more than 90 standard specifications in beam and crank counterweighed types. There's one to suit any pumping need you may have!

More on the next page . . .

National Sucker Rod stack in the yard of National's Anaco, Venezuela store (featured on first page of this insert). National's careful methods for stacking, handling, shipping and field storage have been proved by hundreds of shipments to all parts of the world.

4 big reasons for buying NATIONAL Sucker Rods

National Sucker Rods are:

1. ENGINEERED for maximum resistance to shock, corrosion, fatigue and impulse loads.

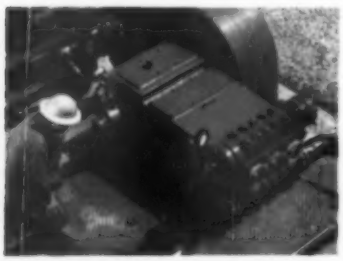
2. QUALITY-CONTROLLED—from laboratory testing of sucker rod steels to final shipment inspections—to give you the ultimate in uniformity, dependability and economy.

3. PRECISION-MANUFACTURED on specially-developed machines—in accordance with the strictest specifications in the industry.

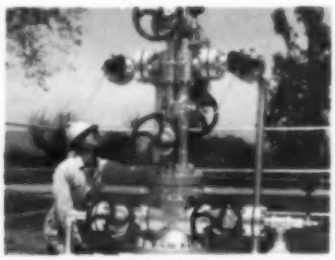
4. CAREFULLY SHIPPED to insure straightness whenever you're ready to use them. National's careful methods for stacking, handling, shipping and field storage have been proved by hundreds of shipments to all parts of the world.

Of course, National has a rod grade for every well condition—normal, mildly corrosive, heavy corrosive or sulphide wells. National Hollow Sucker Rods and Plastic-Coated Rods are also available for special conditions.

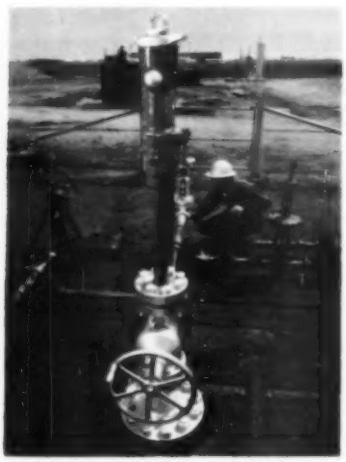
From any standpoint, the choice of a National Sucker Rod string means low-cost sucker rod service. You'll find it worthwhile to review your rod needs with the National Supply field man in your area.



National Triplex Pumps are reliable on a host of oilfield pumping jobs including waterflooding, salt water disposals, formation fracturing, and as power-oil sources for subsurface hydraulic pumps.



National Wellhead Equipment features interchangeable units which provide many combinations for your specific size, capacity and type needs. Ease of assembly and pre-tested safety are two of its outstanding advantages.



National Plunger Lift can be the best production methods for certain types of wells. It uses formation gas or injected gas for operation, has low initial and service costs. Equipment is also available for gas well operation to remove liquids and maintain a uniform and increased flow rate of gas.

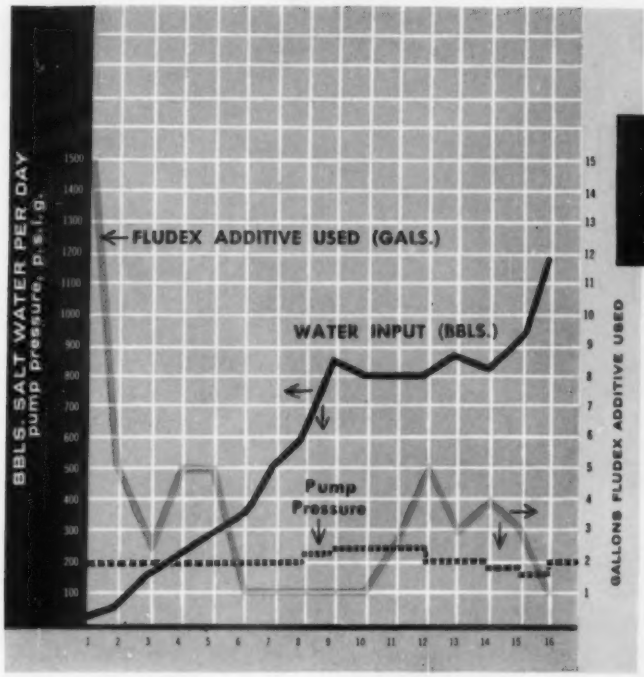
THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1



See our exhibit at the International Petroleum Exposition, May 14-23, and 5th World Petroleum Congress, June 1-5.

another TRETOLITE SERVICE *report*

treatment with one drum of FLUDEX* additive restores "problem" well to useful service

FLUDEX WATER FLOOD ADDITIVE INCREASES SALT WATER DISPOSAL CAPACITY from 15 to 1200 bbls. per 8 hr. day

An East Texas salt water disposal well had a 10 year history of difficulties. It had been acidized 8 times during this period, and treated with 100% chlorine twice a week for 6 years. (Well depth: 3700 feet; 7-inch casing, 5½-inch tubing, bottom of hole open.)

When treatment with FLUDEX water flood additive was started, the daily (8 hour) input capacity was 15 barrels at 200 p.s.i.g.

HOW FLUDEX WATER FLOOD ADDITIVE WAS APPLIED

Ten gallons of FLUDEX additive were dumped into the well, then input pump was started. At the end of 7 hours, the well was taking 2 gallons of water per minute. Five gallons of FLUDEX additive were flushed down the well bore and pumping was discontinued for the night. Total input for this day was 15 barrels.

The following day FLUDEX treatment was resumed, and continued for 15 days. (See chart.) At the end of the 15 day period, input capacity had increased to 1200 barrels per 8 hour pumping period. In addition, with the pump off, the well would take about 30 barrels per hour by gravity flow alone.

For complete information on how FLUDEX water flood additive can help your operations, *ask the Man in the Red Car.* Or write to . . .

TWF-59-1

*FLUDEX *is a registered trade-mark of Petrolite Corporation*

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5515 Telegraph Road, Los Angeles 22, California

CANADA: Petrolite Corporation of Canada, Limited, 309 Alexandra Bldg., Edmonton, Alberta
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VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

REPRESENTATIVES

BRAZIL: WERCO, Ltda., Rua General Gurjao 326, Rio de Janeiro
COLOMBIA: South American Petrolite Corporation, Calle 19, No. 7-30, Office 807, Bogota
GERMANY: H. Costenoble, Guiollettstrasse 47, Frankfort, a.M.
ITALY: NYMCO S.p.A. 9, Lungotevere A. da Brescia, Rome
JAPAN: Maruwa Bussan KK, No. 3, 2-Chome, Kyobashi, Chuo-Ku, Tokyo
KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait
MEXICO: R. E. Power, Sierra de Mijes, No. 125, Mexico, D. F.
NETHERLANDS: F. E. C. Jenkins, Hoefbladlaan 134, The Hague
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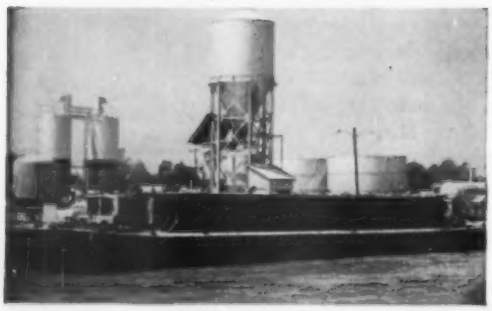
WE HELP ALL KINDS OF OIL MEN



The men who supply the rig, the men who service it, the men who keep it running are all oil men. They are all in the same business, and they are all a necessary part of it. The Oil and Gas Department at The National Bank of Commerce of Houston has the experience and the know-how to help each kind of oil man.

The Commerce can help you because it knows what it's talking about, and, even more important from your point of view, it knows what *you're* talking about. If you are planning to drill, if you are planning to extend needed services, if you are in the oil business, you'll find that The National Bank of Commerce will help you all the way.

E. O. Buck, *senior vice president, Oil and Gas Department.*

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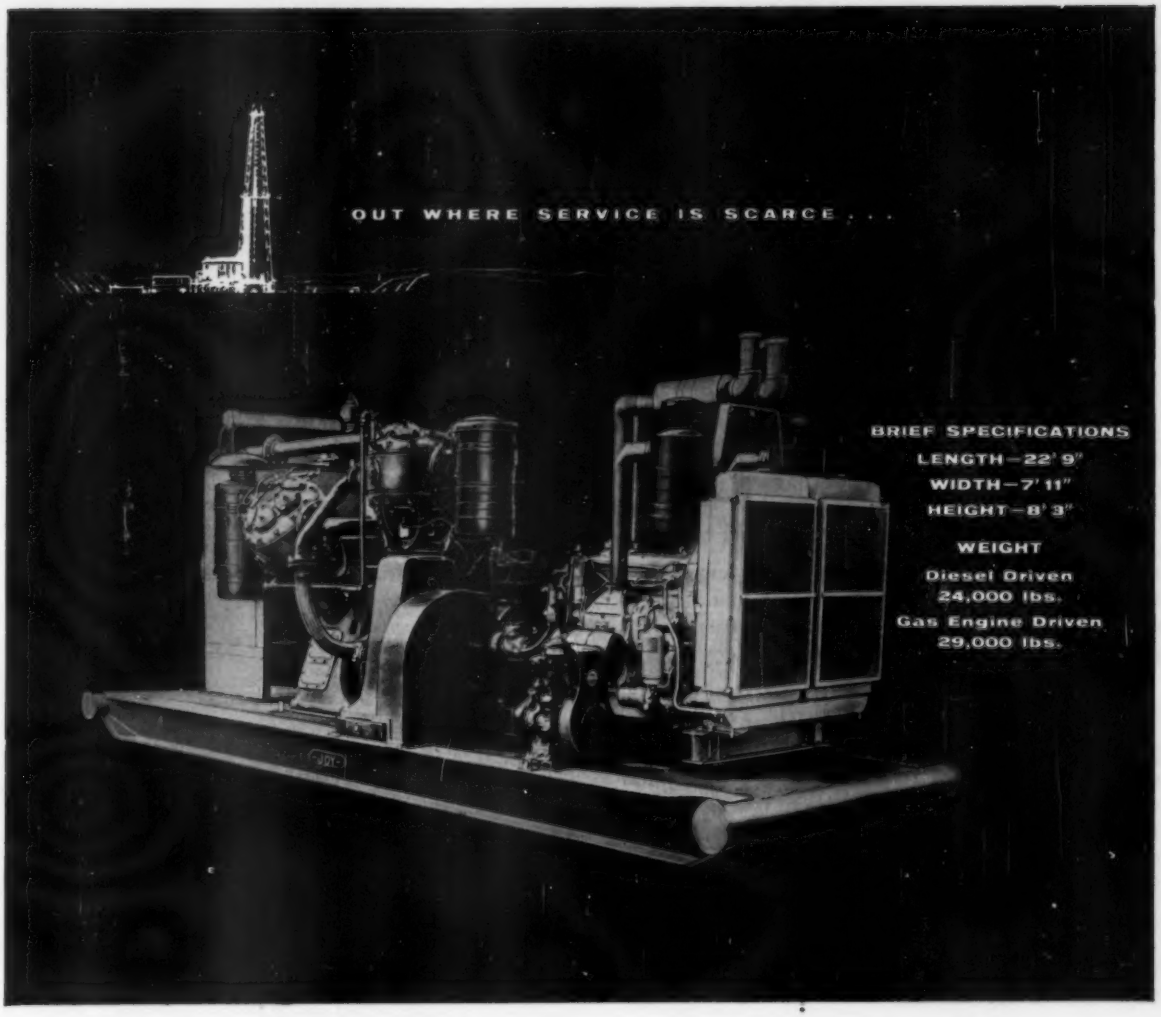
Facilities of the Oil and Gas Department of The National Bank of Commerce of Houston are available in Wyoming, Nebraska, Colorado, New Mexico, Louisiana, Mississippi, and Texas.



THE JOY AP-2 "PACKAGE" COMPRESSOR . . . *designed* FOR AIR DRILLING

DRILLING CONTRACTORS: We found out what you had to have in a compressor to drill with air successfully . . . then we *built* it.

The AP-2 gives you plenty of air . . . 1056 cfm at 125 psi or 647 cfm at 250 psi. The AP-2 is rugged . . . takes all the abuse of day after day operation out in the open. And it has all the features you've asked for: REMOTE CONTROL OPERATION: regulated by lever controls at the drillers console. INSTANT PORTABILITY: mounted on a single, oil-field type skid—ready for over-the-road hauling. TRUE PACKAGE UNIT: Completely self-contained . . . always ready to run.

For real success with air drilling use a compressor *designed* for air drilling . . . the Joy AP-2. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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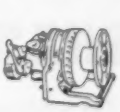
WRITE FOR FREE BULLETIN 171-31

Gas Booster Compressors

Portable Safety Lighting


Portable Hoists

Shot Hole Rigs

HOW TO MAKE EXTRA PROFIT WHEN USING BARITE RECOVERY MACHINES

You will be money ahead if you answer these important questions before using any barite recovery machine

How Is Barite Lost?

Most Barite is lost when the tanks are jetted to remove excess solids in the form of fine drilled clays. *If this jetting were not necessary, there would be little need for a barite recovery machine.* When you jet your tanks to get rid of unwanted clays, you also jet out large quantities of valuable barite. The problem is to *selectively* discard unwanted clays and retain costly barites, while processing a minimum volume of mud.

So What Should A Machine Do?

The first and most important requirement is *to reject drilled clays.* Next in importance is the barite recovery efficiency. Virtually no chemicals used in drilling muds can be separated from drilled clays with practical equipment. For that reason, the higher the clay rejection efficiency, the less mud need be processed. As a result, *chemical and barite losses are held to a minimum.*

High clay rejection efficiency is an important reason why the *Clayjector®* is preferred by so many operators. As a matter of fact, it was named Clayjector to dramatize the importance of clay rejection.

What Are Some Other Requirements?

During mud maintenance, the high clay rejection and barite recovery efficiencies shown in the table below are of great importance. Together they result in less barite lost for each pound of clay removed.

Where reserve pits contain important quantities of barite, the Clayjector is outstanding. It has a much higher capacity than other type machines and it delivers *almost completely pure barite. This is an important advantage when very heavy muds are used,* since the clay content of these muds must be closely controlled.

Because of unusually low rental costs, the Clayjector has been proved profitable when as few as 60 sacks of barite per day are required for mud maintenance.

The Clayjector is simple and easy to operate. It is easy to move and it is flexible in operation. All barite is returned as a smooth slurry that is easy to mix. The unit results in faster drilling and greater safety from lost circulation or blowouts because closer control of mud is possible.

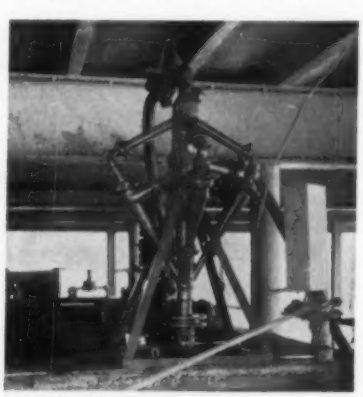
Get the whole story from your SWACO representative or write us direct. If you have been using other barite recovery machines, you will be surprised at the added savings you can make. If you are not using a barite machine, and are using weighted mud of over 11.5 pounds per gallon, you probably can save money by installing a Clayjector.

®Clayjector is trademark of Dorr Oliver, Inc., Stamford, Conn.

FIELD PERFORMANCE DATA ON CLAYJECTORS

	Stream	Weight #/gal	Flow gpm	Bar. Rec. %	% Clay Rejec.
Offshore, La. 15.1 #/gal mud 1 Clone S.G. Bar = 4.18 10/22/58	u.f. o.f.	17.3 8.9	3.3 21.4	95.1	71.1
Offshore, La. 14.8 #/gal mud 2 Clones S.G. Bar = 4.17 11/1/58	u.f. o.f.	17.1 8.9	6.8 40.0	89.7	73.0
Offshore, La. 13.6 #/gal mud 1 Clone S.G. Bar = 4.19 about 11/25/57	u.f. o.f.	16.0 8.8	3.8 21.4	93.8	73.7

U.F. = Underflow — Barite slurry returned to mud system.
O.F. = Overflow — Light solids and fluids to waste.
These results were calculated by an independent testing laboratory from samples taken at the rig.



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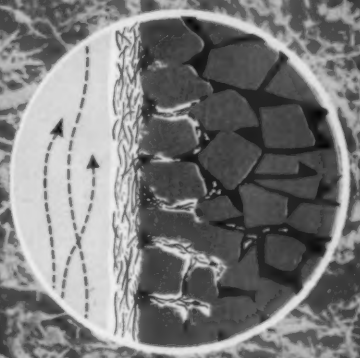
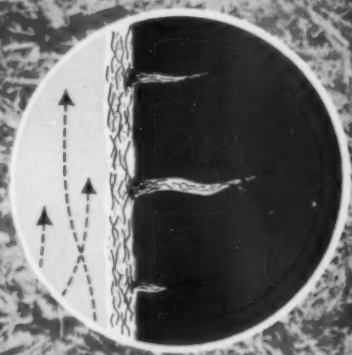
Seeing is believing

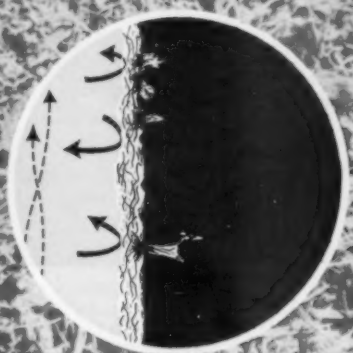
FIBERTEX*



SEALS FORMATION PORES



SEALS FORMATION FRACTURES



RESISTS DECOMPOSITION

strong fibers *permit mud circulation without loss.*

FIBERTEX . . . bridges formation pores and blocks fractures to prevent or stop mud loss.

FIBERTEX . . . graded fiber sizes give quicker, more effective sealing.

FIBERTEX . . . mixes easily, works fast, resists decomposition. A little goes a long way.

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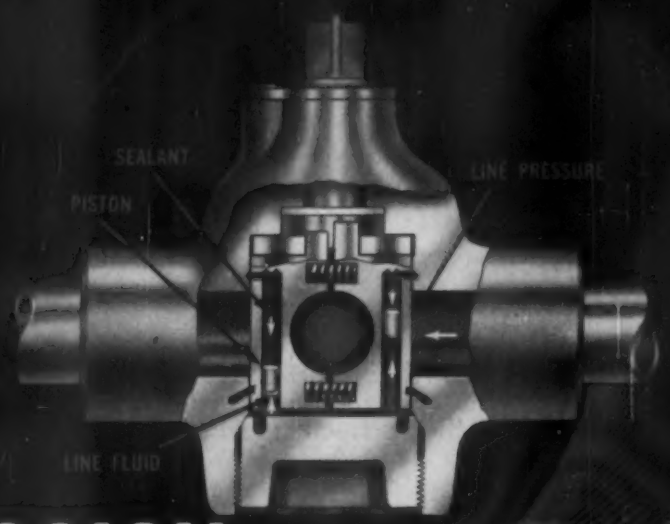

MISSION VALVES

Here's a valve that thinks for itself. A valve that is always working for you without costly maintenance, without constantly being nursed. The Mission Valve is always ready to seal. And what's more, the higher the pressure, the tighter the seal.

Why? Because line pressure forces Mission Sealant through two semi-circular grooves around the downstream port, sealing like a plastic packing, to form a gas-tight seal. Leaks are stopped auotmatically before they start.

The two spherical-cylindrical cores, acting like a gate, are wedge proof, allow easy opening and closing even under pressure. The complete line of 315 Mission Valves brings the positive advantages of easy opening and tight sealing to practically all valve applications. This wide selection, the Mission Guarantee, and the Mission Renewal Policy combine to make Mission Valves your best buy. Specify Mission and eliminate your valve problem.

Nothing but the finest will bear the name of **MISSION** MANUFACTURING CO.

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Tulsa, Oklahoma

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They Say—

Ideco rig in Persian Gulf

DEAR SIR:

JANUARY 26 ISSUE, PAGE 116, "PERSIAN GULF ALIVE WITH RIGS," THIRD PARAGRAPH, THIRD LINE SHOULD READ IDECO E-2500, NOT EMSCO PAN AMERICAN RIG.

DICK PERDUE
ADVERTISING MANAGER
IDECO, INC.

Pan Am rig built by Ideco

Dear Sir:

As a subscriber to The Oil and Gas Journal I usually look forward each week to reading my copy. Your issue of January 26 was a disappointment. I refer to page 116 where there seems to be a serious misprint.

I believe that with regard to the Pan American International Oil Co. DeLong-type barge which is being outfitted in Orange, Tex., your copy should have said "Ideco E-2500 rig" instead of "Emsco 2500-E rig."

Shannon L. Matheny, Jr.
Technical Service Engineer
Ideco, Inc.
New York.

Oil in India story one-sided

Dear Sir:

The Journal issue dated November 24, 1958, has just reached me. The article by Henry Carter Rea on India's oil potential contains many inaccuracies and appears to me to be a rather one-sided criticism.

Mr. Rea says that a 60,000-bbl. refinery at Calcutta operates at present on imported crude. It is really amazing how a person who has been an oil adviser to the Government of India is not aware that there is no refinery at present in or around Calcutta.

Mr. Rea says that American oil companies were reluctant to invest capital in India because of its nationalization law. Is he not aware that a 25-year guarantee against nationalization has been given to the three new refineries, two of which have been financed by American capital? I wonder if the development rebate and the accelerated depreciation offered by the Indian Government to the three new refineries have a parallel anywhere else.

Mr. Rea has nothing to say on the exploration currently being carried out by the Standard-Vacuum. A 10,000-sq.-mile concession was granted to Standard-Vacuum by the Indian Government in 1953.

Mr. Rea asserts that the Indian oil and natural gas commission has spent $68 million and that most of the money has gone to Russia. Neither of the assertions is true.

Mr. Rea ends his article with rather a pessimistic note. What exactly has he in mind when he says that the American loans and aid are being used by the government to entrench its ideas? What are these ideas?

If there is to be any sizable degree of industrialization in a country where industry is practically nonexistent, the little capital outflow that is available has to be preferentially diverted to basic heavy industries. One does not have to be an expert to realize that if there were an unfettered free enterprise in a developing industrial economy, the capital would flow into consumer goods industries, built probably with imported equipment, which generally give the maximum return in a short period of time but which do not in the long run increase the wealth of the nation.

It is, therefore, necessary for a country like India to have a certain degree of governmental control or share in at least the vital industries.

What is generally not realized by Americans is that what has succeeded in the United States need not be equally successful or effective elsewhere. The differences in approach need not always be communist inspired.

P. Rajagopal
Chemical Engineer
Standard-Vacuum Refining Co. of India, Ltd.
Bombay, India.

Two different matters

Dear Sir:

It is very disturbing that the press and, by their silence and occasional remarks, the oil companies, have placed so much emphasis on the importance of the "50-50" formula in the new concessions being awarded by various nations.

In a fictitious case, who is to say which is the better deal:

1. A cash bonus of $200,000,000 plus 25% of the profits (if any).

2. A cash bonus of $10,000,000 plus 75% of the profits (if any).

What the oil companies really fear, and rightly so, is the abrogation of

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is so much more important to business concerns today

By leasing an apartment at The Barclay on an economical year 'round basis, you'll be assured of these definite advantages:

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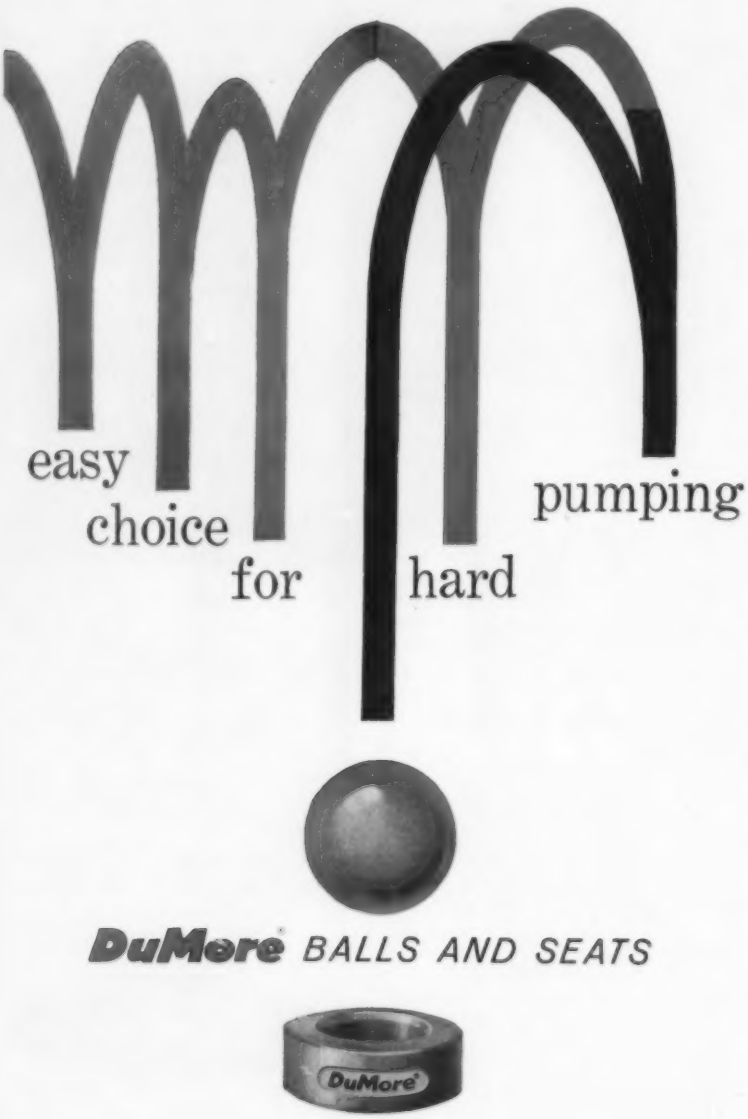
Hard pumping, or corrosive or abrasive fluids, often result in frequent, expensive pulling jobs due to valve failures. If you are having this problem, the solution lies in genuine DuMore Balls and Seats. DuMore, a special composition of chromium, cobalt, and tungsten, will take any kind of punishment because of its exceptional resistance to impact and pressure. Every DuMore Ball and Seat is manufactured to exact A.P.I. specifications. Each ball is precision ground to a sphericity of .0001". Each seat is individually ground and mated to its ball, vacuum tested, and individually packaged to assure perfectly-matched sets. Ask your supply store about DuMore. They'll tell you it's the best ball and seat you can run.



existing agreements. But the two issues have become so badly confused that the apparent break-through of the 50-50 principle, such as is claimed in certain new concessions, is received in foreign quarters as a signal that existing agreements should also be modified.

Actually the principles involved have no connection whatsoever, the former being a matter of competitive bidding, and the latter a matter of national integrity. However, in the U. S. and U. K. at least, we have in general made little effort to effectively separate the two unrelated issues, and thus have only ourselves to blame when they are confused by others to our detriment.

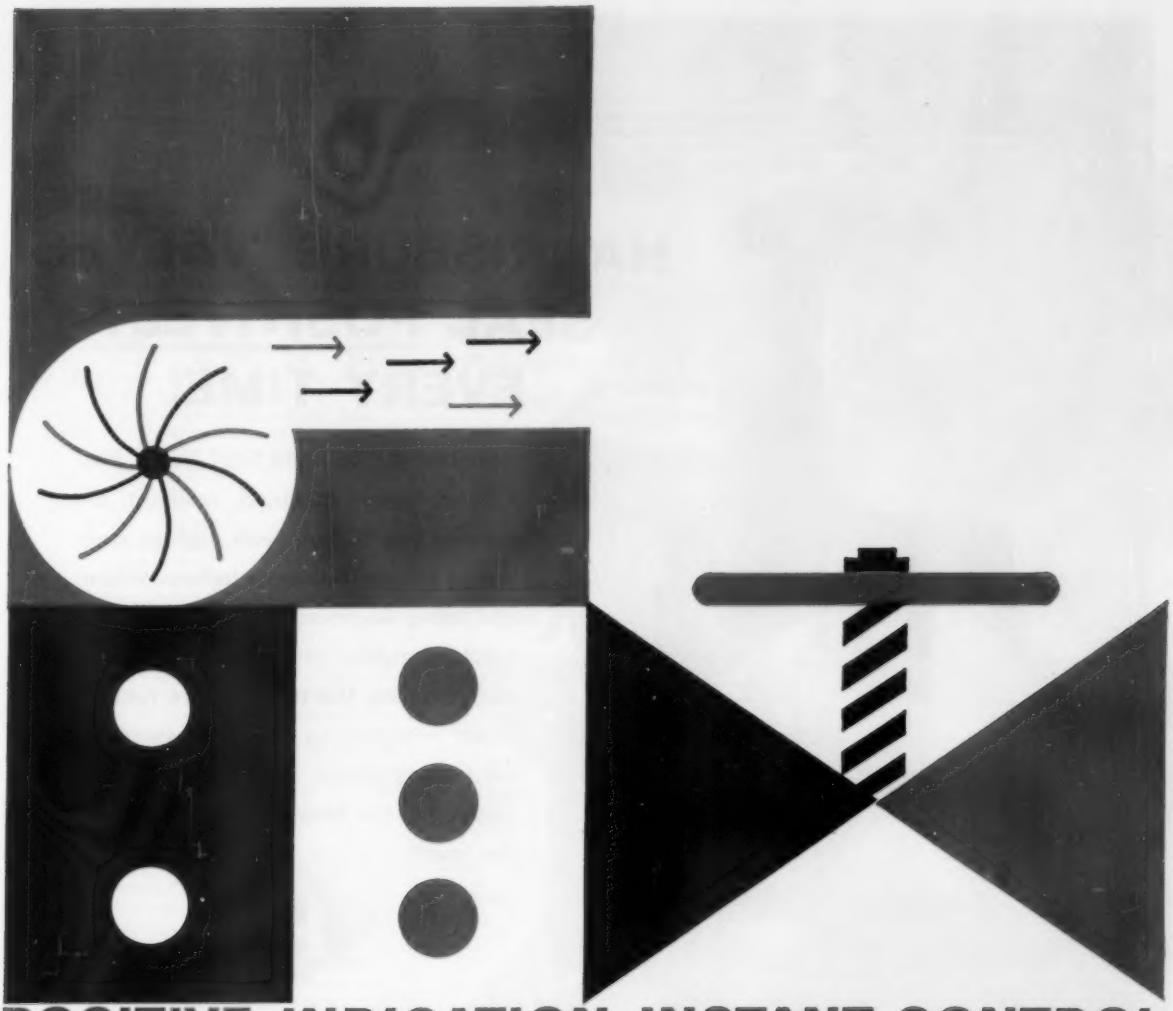
Paul F. Clement
Tehran, Iran.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

MARCH

- **3** Petroleum Equipment Suppliers Association, Pacific district, annual membership meeting, Ambassador Hotel, Los Angeles.
- **3** Oklahoma City Geophysical Society, symposium on continuous velocity logging, Lake View Country Club, Oklahoma City.
- **4-5** University of Oklahoma, gas-processing conference, Norman, Okla.
- **4-6** American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Scharbauer, Midland, Tex.
- **5-6** Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.
- **6** Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.
- **7** American Chemical Society, Oklahoma tetrasectional meeting, University of Tulsa, Tulsa.
- **8-11** American Society of Mechanical Engineers, gas turbine power conference and exhibit, Netherlands-Hilton Hotel, Cincinnati.
- **9-11** Midwest Gas Association, annual meeting, Hotel Fort Des Moines, Des Moines.
- **11** Petroleum Equipment Suppliers Association, southwestern district, annual membership meeting, Shamrock Hilton Hotel, Houston.
- **13** American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section; sixth annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.
- **16-18** Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.
- **16-19** American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, for-



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S&J Gardtrol units continuously report actual conditions at remote points. They also allow instant change of conditions by the operator. Gardtrol Valve Monitor shows open, opening, closing, closed or stopped (partly closed) conditions. Gardtrol Pump Motor Monitor indicates on or off. Both have simple illuminated push button controls for all functions. Only one small wire—plus a common return—is needed between control unit and the field unit. S&J Gardtrol assures reliable supervisory control at lowest cost.

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Harrisburg's Resilient Seal Valve has a new, totally confined, resilient, U-shaped insert that seals tighter and wears longer than ever before. When the valve is closed, resilient Buna-N synthetic rubber molded to the wedge gate fits into the arms of the rubber insert — applying equal pressure to all sealing points. *The more pressure applied to the handwheel—the tighter the seal!*

HARRISBURG
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Other features of the Harrisburg Resilient Seal Valve:

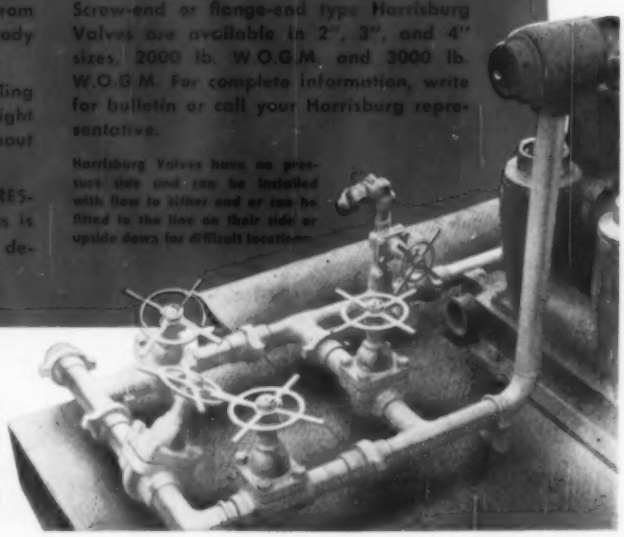
MAXIMUM RESISTANCE TO ABRASION from circulating fluids because the valve body is machined high strength alloy steel.

SIMPLE TO SERVICE because the sealing rubber and wear rings can be lifted straight out of the body for replacement without breaking the circulating line.

FAST AND EASY OPENING UNDER PRESSURE with a minimum number of turns is made possible by the double thread design on the stem nut.

Screw-end or flange-end type Harrisburg Valves are available in 2", 3", and 4" sizes. 2000 lb. W.O.G.M. and 3000 lb. W.O.G.M. For complete information, write for bulletin or call your Harrisburg representative.

Harrisburg Valves have no pressure side and can be installed with flow to either end or can be fitted to the line on their side or upside down for difficult location—



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ty-fourth annual meeting, Memorial Auditorium, Dallas.

16-20 National Association of Corrosion Engineers, fifteenth annual conference, Hotel Sherman, Chicago.

17-18 Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.

18 Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.

19 Independent Oil Producers and Land Owners Association, Tri-State, annual meeting, McCurdy Hotel, Evansville, Ind.

19-20 New England Gas Association, annual meeting, Hotel Statler, Boston.

21 North Texas Oil and Gas Association, twenty-ninth annual meeting, Kemp Hotel, Wichita Falls, Tex.

23-24 University of Oklahoma, second conference on theory of fluid flow through porous media, Norman, Okla.

25-27 American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

26-27 Southern California Meter Association, eighth annual instrument short course, Los Angeles Harbor Junior College, Wilmington, Calif.

31 Seventh annual meeting, Philadelphia-Wilmington section of American Institute of Chemical Engineers, and University of Pennsylvania, Philadelphia.

29-Apr. 2 American Society of Mechanical Engineers, instruments and regulators division conference, Case Institute of Technology, Cleveland.

APRIL

2-3 Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

2-3 American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

2-6 Geological Society of America, Cordilleran section, annual meeting, University of Arizona campus, Tucson.

5-10 Engineers Joint Council, nuclear congress, Cleveland Auditorium, Cleveland.

5-10 American Chemical Society, national meeting, Boston.

6-7 Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

7-8 Sixth Gas Compressor Institute, sponsored by University of Kansas and Southwest Kansas petroleum industry, Randall's Cafeteria, Liberal, Kans.

8-9 Western Petroleum Refiners Association, computer conference, Hotel Tulsa, Tulsa.

8-10 American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

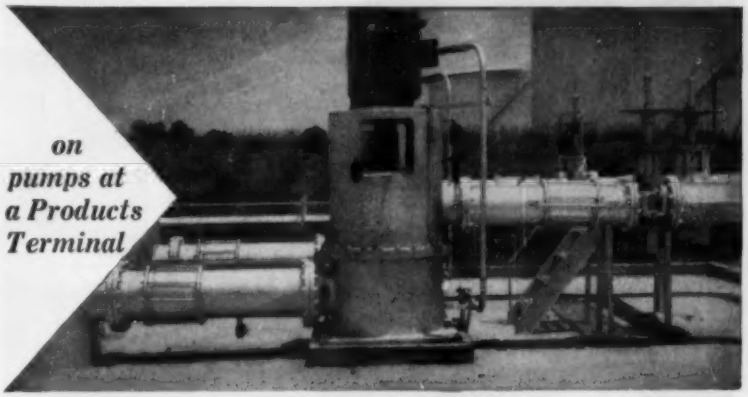
14 Independent Oil Men's Association of New England, annual meeting, Hotel Statler, Boston.

14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

15-17 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

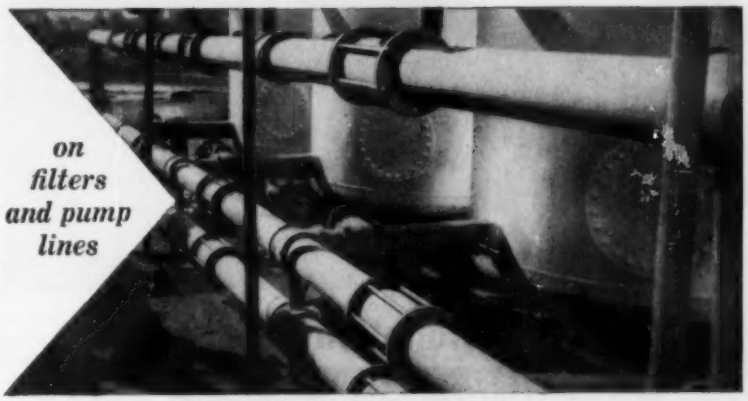
15-17 American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.

Dresser® Couplings—



on pumps at a Products Terminal

easy, bottle-tight...



on filters and pump lines

safe, permanent joints!

Dresser Couplings are easily installed and bottle-tight for life! The specially compounded Dresser Gasket provides rugged "give and take" to absorb vibration, settlement and other stresses that might cause damage. And there's no pipe threading. With plain end pipe, any workman can install Dresser Couplings in an average two man-minutes per bolt *using only a wrench*. And even with pipe deflection up to 4°, you still get a perfect Dresser-Coupled joint. Send for Dresser Catalog No. 531; it contains more detailed information and complete specifications on *all* Dresser Couplings, Fittings and Pipe Repair Products.

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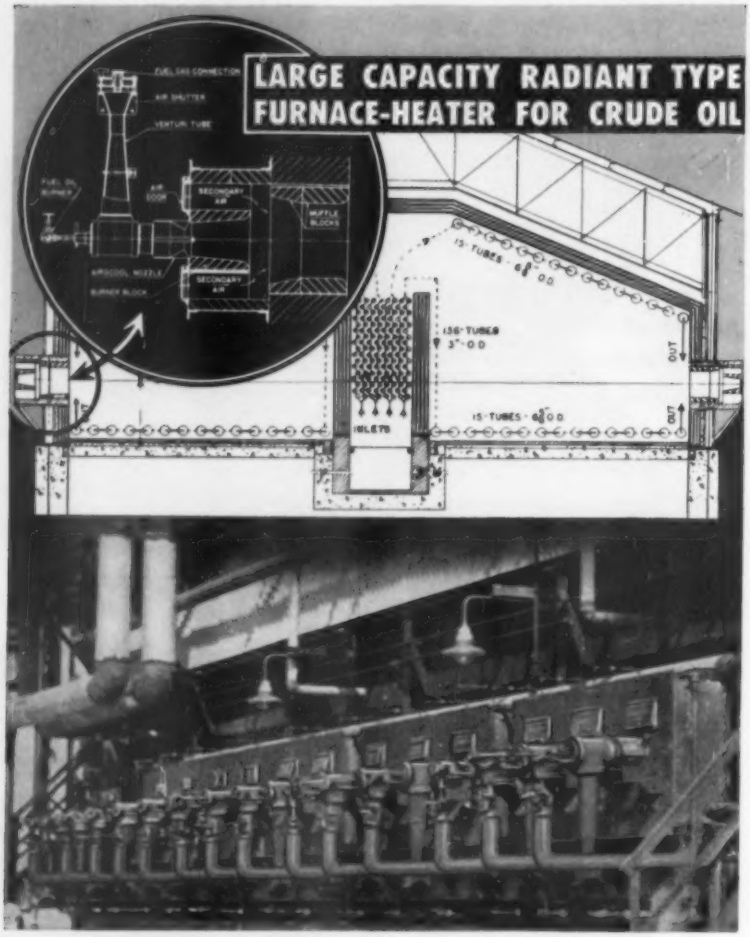

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National Airoil Combination Gas and Oil Tandem Units play a significant role in accomplishing this result by uniformly distributing the heat without flame impingement to the tube surfaces at the same time insuring complete and efficient combustion throughout a wide capacity range.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

16-17 Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.

18-22 Petroleum Equipment Suppliers Association, twenty-fourth annual meeting, Boca Raton Hotel and Club, Boca Raton, Fla.

19-23 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.

22-24 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.

22-24 Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

23-24 Sixth annual West Texas oil lifting short course, Texas Technological College, Lubbock, Tex.

24-25 Society of Economic Paleontologists and Mineralogists, Pacific Coast section, annual spring field trip, Boulder Creek area of Santa Cruz Mountains, California.

26-28 Texas Independent Producers and Royalty Owners Association, membership meeting, Baker Hotel, Dallas.

27-28 Society of Exploration Geophysicists, annual midwestern meeting. Cortez Hotel, El Paso, Tex.

29-30 Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting. Hotel Paso del Norte, El Paso.

29-30 Pacific Coast Gas Association, operating section, transmission conference, El Mirador Hotel, Palm Springs, Calif.

30-May 1 American Petroleum Institute, Division of Production, Pacific Coast district meeting. Biltmore Hotel, Los Angeles.

MAY

1 Fourth annual petroleum accounting conference, sponsored by Wichita chapters of the Petroleum Accountants' Society of Kansas. National Association of Accountants, the Kansas Society of Certified Public Accountants, and the University of Wichita, Lassen Hotel and University of Wichita campus, Wichita.

3-6 Liquefied Petroleum Gas Association, twenty-eighth annual meeting and trade show, Conrad Hilton Hotel, Chicago.

4-5 American Society of Mechanical Engineers, maintenance and plant engineering division conference, Edgewater Beach Hotel, Chicago.

4-7 American Geophysical Union, annual meeting, Washington.

5-7 Purdue University, fourteenth Purdue industrial-waste conference, Purdue Memorial Union Building, Lafayette, Ind.

6-7 Panhandle Producers and Royalty Owners Association, annual meeting, Amarillo, Tex.

6-8 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

7-8 Society of Petroleum Engineers of AIME, Permian Basin section oil recovery conference, Midland, Tex.

13-15 American Petroleum Institute, Division of Transportation, annual pipeline conference, Pittsburgh.

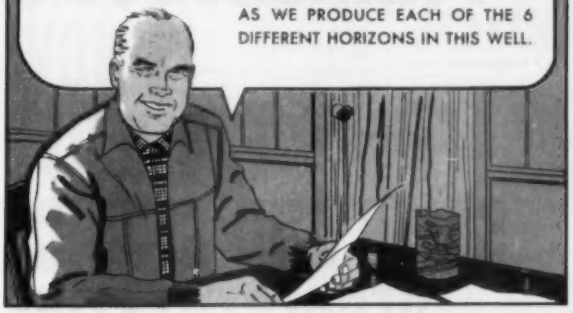
14-23 International Petroleum Exposition, Tulsa.

1

OTIS SLIDING SIDE-DOOR EQUIPMENT

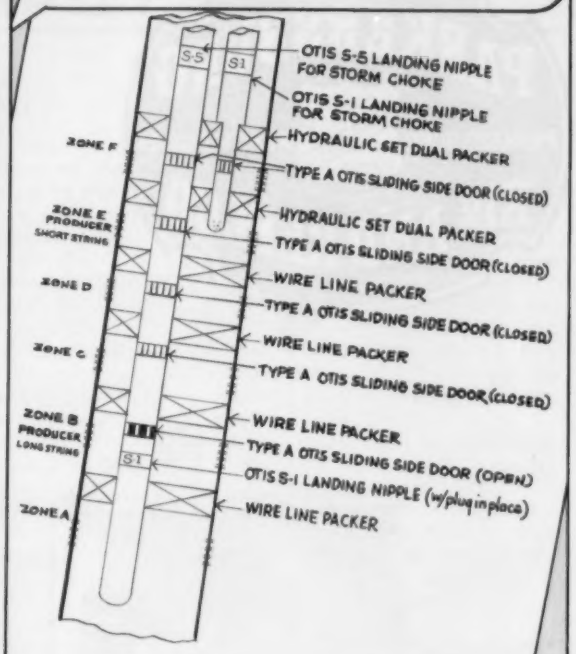
WILL SAVE US SEVERAL HUNDRED DOLLARS PER ZONE

AS WE PRODUCE EACH OF THE 6 DIFFERENT HORIZONS IN THIS WELL.



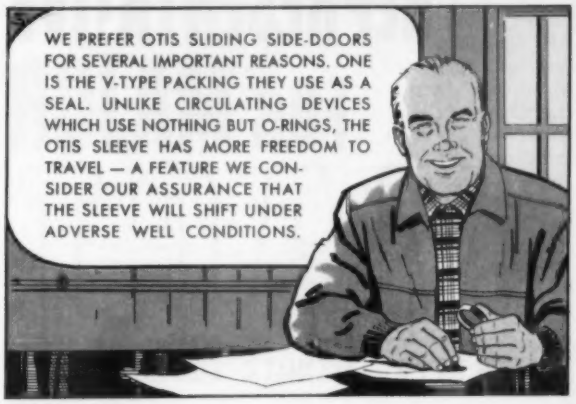
2

ADD TO THAT THE THOUSANDS OF DOLLARS WE SAVED BY DRILLING ONLY ONE WELL TO PRODUCE THESE 6 FORMATIONS AND YOU'LL SEE WHY WE'RE SOLD ON MULTIPLE-ZONE WELLS AND OTIS SLIDING SIDE-DOOR EQUIPMENT. HERE'S A DIAGRAM OF THE WELL.


S-5
S1
OTIS S-5 LANDING NIPPLE FOR STORM CHOKE
OTIS S-1 LANDING NIPPLE FOR STORM CHOKE
ZONE F
HYDRAULIC SET DUAL PACKER
TYPE A OTIS SLIDING SIDE DOOR (CLOSED)
ZONE E PRODUCER SHORT STRING
HYDRAULIC SET DUAL PACKER
TYPE A OTIS SLIDING SIDE DOOR (CLOSED)
ZONE D
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE DOOR (CLOSED)
ZONE C
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE DOOR (CLOSED)
ZONE B PRODUCER LONG STRING
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE DOOR (OPEN)
S1
OTIS S-1 LANDING NIPPLE (w/plug in place)
ZONE A
WIRE LINE PACKER

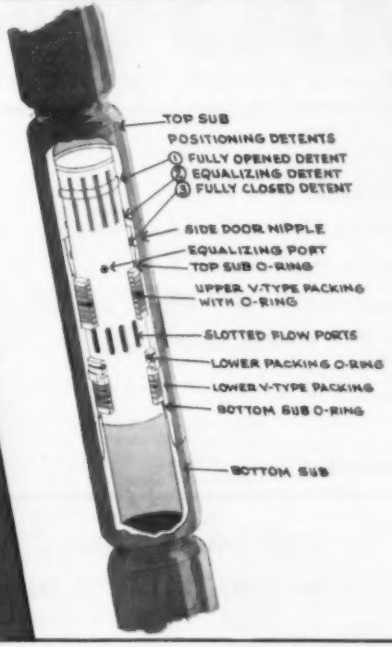
3

WE PREFER OTIS SLIDING SIDE-DOORS FOR SEVERAL IMPORTANT REASONS. ONE IS THE V-TYPE PACKING THEY USE AS A SEAL. UNLIKE CIRCULATING DEVICES WHICH USE NOTHING BUT O-RINGS, THE OTIS SLEEVE HAS MORE FREEDOM TO TRAVEL — A FEATURE WE CONSIDER OUR ASSURANCE THAT THE SLEEVE WILL SHIFT UNDER ADVERSE WELL CONDITIONS.



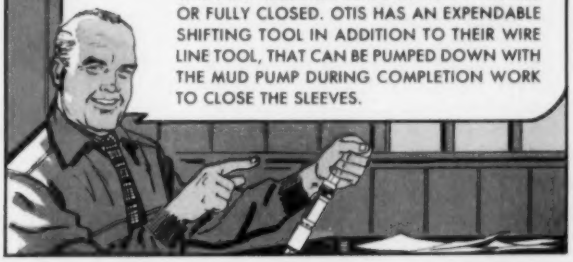
4

THEN THERE'S OTIS' VERTICAL SLOTTED PORT DESIGN. THIS GIVES OTIS SLIDING SIDE-DOORS MAXIMUM STRENGTH—AND ACTS TO PREVENT DISTORTION OF THE TOOLS AS THEY ARE SUBJECTED TO THE STRESS AND TORQUE OF A PRODUCTION STRING. HERE'S A DETAILED DRAWING OF THE TYPE A OTIS SLIDING SIDE-DOOR. NOTICE THE DESIGN ADVANTAGES.



5

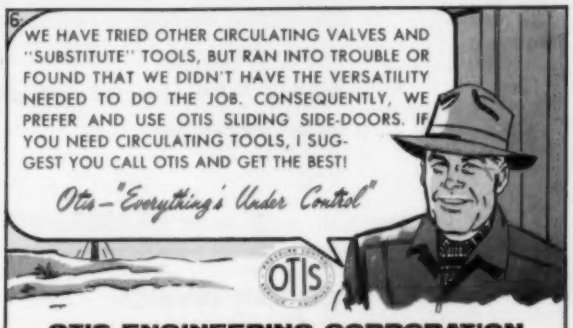
ANOTHER ADVANTAGE OF THIS OTIS EQUIPMENT IS THAT WITH THEIR SHIFTING TOOL THEY CAN OPEN AND/OR CLOSE ONE OR SEVERAL SLEEVES WITH JUST ONE TRIP OF THE WIRE LINE. AND YOU'RE SURE THE SLEEVES ARE FULLY SHIFTED, TOO. OTIS' SHIFTING TOOLS WON'T RELEASE UNTIL THE SLEEVES ARE EITHER FULLY OPENED OR FULLY CLOSED. OTIS HAS AN EXPENDABLE SHIFTING TOOL IN ADDITION TO THEIR WIRE LINE TOOL, THAT CAN BE PUMPED DOWN WITH THE MUD PUMP DURING COMPLETION WORK TO CLOSE THE SLEEVES.



6

WE HAVE TRIED OTHER CIRCULATING VALVES AND "SUBSTITUTE" TOOLS, BUT RAN INTO TROUBLE OR FOUND THAT WE DIDN'T HAVE THE VERSATILITY NEEDED TO DO THE JOB. CONSEQUENTLY, WE PREFER AND USE OTIS SLIDING SIDE-DOORS. IF YOU NEED CIRCULATING TOOLS, I SUGGEST YOU CALL OTIS AND GET THE BEST!

Otis—"Everything's Under Control"



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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Imports Paradox

With the whole industry on edge over imports of foreign oil and plans to limit them, it might be well to recall that the imports problem is not new to the petroleum industry.

In fact, it is 101 years old.

That's right—101 years. And yet the industry will be only 100 years old next August. How come?

The first commercial imports of crude oil on record were made in 1858. The Drake well, which officially marks the birth of the oil industry, was not drilled until 1859.

This interesting paradox came about in this way:

In the mid-1850's there were several score refineries in the United States distilling lamp oil out of oil shale, soft coal, lignite, peat, or tar, mostly licensed under British or Canadian patents. This "coal oil" (one brand was trademarked "Kerosene") smoked and had a bad odor, but it was better than candles and cheaper than whale oil.

Still it wasn't good enough, and there was much experimenting to find something better. One of these experimenters was Samuel M. Kier of Pittsburgh. He operated salt wells at nearby Tarentum but a lot of crude oil came up with the brine and had to be skimmed off and burned in a sump. Kier tried to develop a market for it by distilling it into lamp oil but his product smoked so badly that he couldn't sell it.

Another experimenter, and a more successful one, was James Miller Williams of Canada, who produced crude oil from wells around an oil spring not far from Sarnia. He operated a small refinery and marketed some lamp oil but it, too, was pretty smoky and malodorous.

Then, about 1857, both these experiments came to the attention of Col. A. C. Ferris of New York, one of the largest refiners and merchandisers of coal oil. He ran samples of both products through his "modern" coal distillery, removed the sulfur and other impurities with sulfuric acid and caustic soda, devised a better lamp and wick, and found that he had the best and cheapest lamp oil ever.

Ferris made a trip to Canada and got an option to buy Williams' entire producing properties for $26,500. He was unable to raise the capital, so settled for a contract to purchase all the crude oil Williams could supply. He made Kier his Pennsylvania crude-oil man and had him scouting the Appalachian area buying up all the petroleum that could be skimmed from salt wells and oil springs.

In 1858—the year before oil was "discovered"—Ferris purchased and refined 1,183 bbl. of crude oil. Kier supplied 1,008 bbl. of this, and the other 175 bbl. was imported from Williams in Canada.

Kier averaged about $20 per 40-gal. barrel for his crude, but Williams got only $11 per barrel for his.

Thus "cheap foreign crude" was a factor in the oil industry before there was any oil industry. Incidentally, the U. S. Government collected $285 in import duties on Canadian crude in 1858.

It was the offer of Ferris and other coal-oil refiners to pay $20 per barrel for crude oil that sent Drake—and many others—frantically searching for new supplies. Drake had the good luck to drill the first commercial well and get posthumous fame as father of the oil industry, but that's all the luck he did have. He died broke.

So many other people drilled so many more wells and produced so much more oil that the price of crude dropped to about a dime a barrel within a year. This effectively snowed under the Canadian import threat, and no more was heard about it for nearly 100 years.

If you're inclined to moralize on this bit of memorabilia, you might draw some lessons for today. One might be that the way to stop imports is to cut costs and outproduce the foreigners. Another might be that we need never worry about a supply of oil if the price is right.

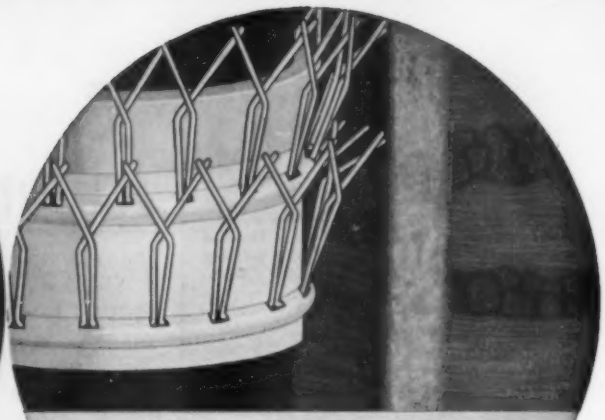
And here's a note for the IPAA, which is trying to get imports rolled back to the "historic" 1954 ratio of 16% of domestic production:

In 1858 imports were 17.36% of domestic crude production. Now there's a really historic ratio to shoot for, one that would antedate not only the vested interests of the present importers but the entire petroleum industry as well.

—Henry D. Ralph

BAKER CONTROLLED SCRATCHING

OFFERS MORE THAN EFFECTIVE MUD CAKE REMOVAL

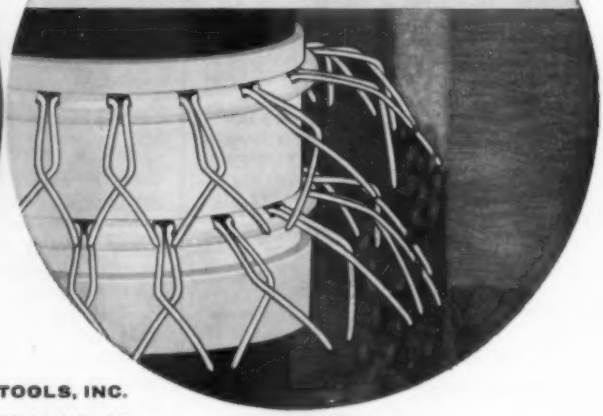


When the casing is being lowered, the scratcher wires swing freely upward and do not remove mud cake which can plug the annulus and cause dangerous pressure surge build-up.

BAKER

After reaching the area to be cemented, the hinged scratcher wires extend to contact the wall of the hole, and when the casing is reciprocated...

...scissors-like operation of the overlapped wires—over the full circumference of the well bore—effectively removes the mud cake which is circulated safely out of the hole.



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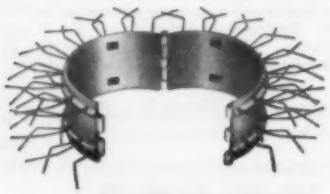
Controlled Scratching not only means more effective mud cake removal for a better cementing bond, but protects against destructive pressure surges while running casing. Baker Scratchers supplement the pressure-reducing performance of Baker FILL-UP Equipment, and the superior centering action of Baker Casing Centralizers, to provide *more* than a good cement job.

The Baker representative, and your supply store are ready to serve you.

Baker Wall Scratchers are available in the "Solid-Ring Type, (Product No. 901-C) which are slipped *over* the casing; and the "Hinge-Lok" (Product No. 900-C) which fastens *around* the casing. Both types can be positioned with either Solid or Split-Ring Baker no-weld Stop Rings to avoid harmful welding on casing.



An offshore spurt, but not general resurgence

THE surprisingly high bids for Louisiana offshore leases last week are an encouraging sign of increasing activity and a demonstration that a good many operators believe the domestic oil industry is here to stay.

But it doesn't necessarily mean that offshore operations generally have come out of the doldrums and are heading for a new boom.

The combination of special circumstances surrounding the sale add up to just one thing of industry-wide significance: The oil business in 1959 is ready to move ahead slowly but steadily toward a higher level of activity in anticipation of bigger market demands a couple of years hence.

THE SEVERE PROBLEMS of far-offshore work—deep water, difficult transportation, high costs—are largely lacking in the tracts just leased. They are within 3 miles of shore, in proven or semiproven areas, in shallow water where drilling cost may be lower than on many onshore sites, and with higher allowables than onshore wells.

This was the first sale of state leases in months and its timing demonstrates what some governments have learned but others have not, namely that the industry can digest new territory only just so fast. While Louisiana operators have not exactly run out of places to drill, many bidders found these tracts more attractive places to spend this year's leasing and drilling budgets than any others in their portfolios.

A sharp increase in drilling within months is assured. Operators can hold their leases much more cheaply by commencing development work within a year than by paying the annual delay rental of one-half the cash bonus of their bids.

It's a different story in the outer zones, far from land and in very deep water. There the prospects for the next couple of years at least are for slow development and little more drilling than the minimum required to meet lease obligations and keep equipment in use.

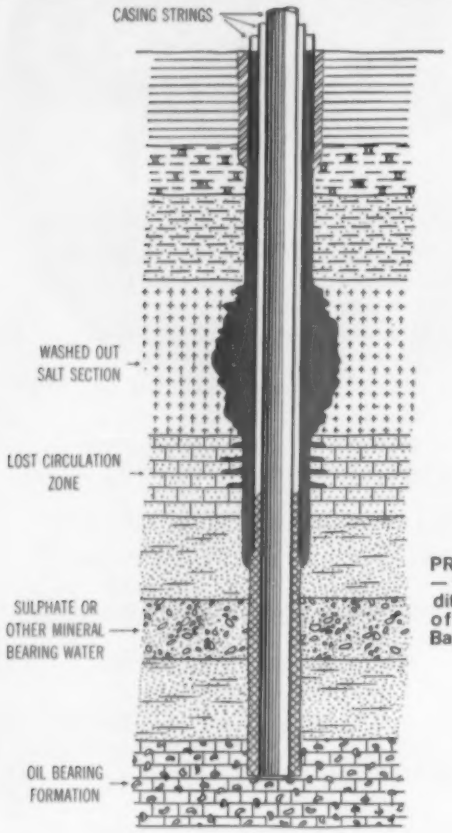
This prospect is not discouraging, in the long view. It is separating the men from the boys, shaking out speculators who climbed on the offshore bandwagon during the boom, and giving time to study cost-cutting methods.

THIS PART OF THE GULF OF MEXICO still looks like one of the best areas on the continent from the standpoint of discovering reserves per dollar spent in exploration. And by the time they are really needed it may be more economical to produce these reserves.

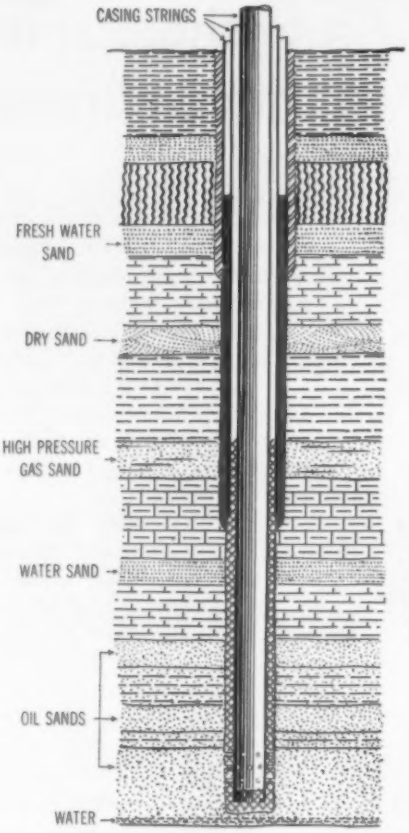
Meanwhile, steady progress is being made in improving techniques of deep-water drilling and production, overcoming transportation difficulties, and other ways of reducing the presently staggering costs.

When demand for oil increases so that allowables can be set on an economic basis and the price of oil firms up, these far-offshore reserves will be produced in volume.

PROTECTION ...where Protection is Needed



PROTECTION — under conditions typical of Permian Basin area.



PROTECTION— under conditions typical of East Texas and the Gulf Coast.

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Lone Star cements are performance-proved in thousands of wells, and are continuously laboratory-tested to meet the most exacting oil-field requirements. Choose the cement proved time and again under almost every conceivable oil-field condition.

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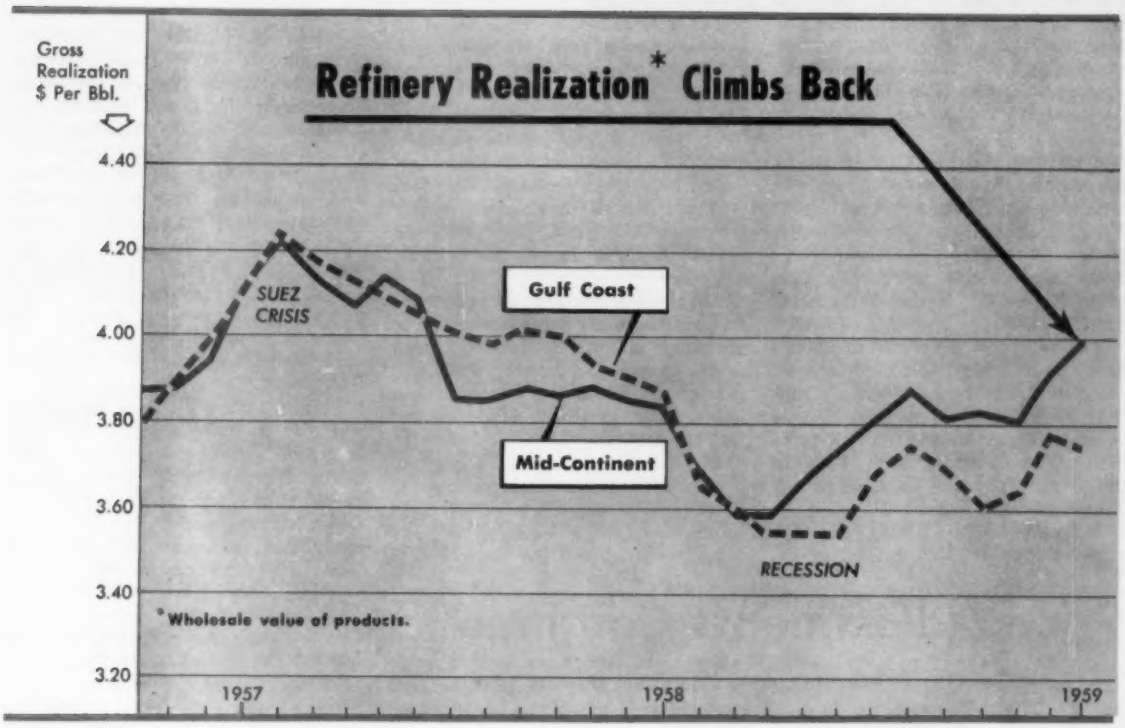


Refiners' Income Picture Brightens

• Their gross return from a barrel of crude has risen steadily from last spring's low point. It's still far below peaks induced by Suez crisis.

DOMESTIC refiners are closing out the winter season in a better economic climate. But it's still nothing to cheer too loudly about.

Consider the outlook:

Total demand has been exceptionally good since late November.

Level of product prices also has risen, especially the price of the middle distillates and even heavy fuel oil. Gasoline prices in some areas also held up well considering the off season.

Cost of crude oil, the refiner's major expense item, has steadily dropped in the last few months.

But one good index of better times for the refiner: His gross realization from a barrel of crude has risen.

Mid-Continent refiners in January realized an estimated gross income of $3.99 for each barrel of crude processed. Gulf Coast refiners realized a gross of $3.75, lower than the Mid-Continent mainly because of somewhat softer gasoline markets on the coast.

In each case, the gross income represented a long climb up from the low points of 1958's recession. The Mid-Continent refiner hit bottom on prices in April when his realization was $3.58 a barrel. The Gulf Coast refiner bottomed out at $3.54 a barrel in May and June.

But the refiner's net realization from a barrel of crude may have risen even more sharply, because of the cuts in crude prices. These cuts have averaged 12.5 cents a barrel in the last 17 months (OGJ, Feb. 23, p. 71).

Take the Mid-Continent refiner as an example. In April 1958, his gross realization was $3.58 a barrel. A typical 36°-gravity Oklahoma sweet crude cost him $3.07 a barrel. This left a spread of 51 cents a barrel to cover costs of gathering, transporting, processing, depreciation, and any profit.

It's small wonder refiners at that stage of the recession all reported they were losing money. The small spread also explained why the price of Oklahoma and Kansas crude was under such pressure at that time and was cut during the month.

By January comparable statistics show how far the refiner had come since spring. The Mid-Continent processor now had a gross realization of $3.99 a barrel. His crude cost $2.97, an average 10-cent drop for this typical sweet. This left a spread of $1.02 a barrel, or exactly a 100% increase in 9 months.

Conditions didn't improve quite so much for the Gulf Coast refiner. His gross realization picked up 21 cents a barrel from April to January com-

pared with his Mid-Continent colleague's 41-cent gain.

Just how much he actually realized is difficult to estimate because Gulf Coast refiners run such a variety of crudes all bearing different price tags. All these crudes, however, suffered price cuts in the period and it's a sure bet that the refiners' spread climbed as a result. The same conditions prevailed on both the East and West coasts.

Not all rosy . . . In spite of recent gains, domestic refiners still have not returned to pre-Suez levels of profit.

In November 1956 just prior to the big oil lift to Europe, the Mid-Continent refiner had a gross realization of $3.87 a barrel. His crude then cost $2.82 a barrel for a spread of $1.05.

This is 3 cents more than his spread today on a higher price level. Besides, the refiner now has to cover a recent 5% wage increase and higher costs of other supplies and services for processing. The amount he is able to carry to net profit is considerably below pre-Suez levels.

Refining activity during the Suez crisis naturally was the highest in several years. Gross realization at the peak of the oil lift was $4.24 on the Gulf Coast and $4.23 in the Mid-Continent in February 1957.

Even with a 25-cent crude-price increase just imposed a month before, the Mid-Continent refiner was able to realize a spread of $1.16 a barrel in February of that year. He hasn't been able to do that well since.

The outlook . . . What happens to refinery realizations in the months ahead will depend on gasoline prices.

The heating-oil season, for all practical purposes, is over. Even with a few more cold spells, buyers will use caution in laying in supplies of heating oils.

This is also a period just before the motoring season when gasoline stocks are still building. Refiners will need to use caution in adjusting yields and runs or gasoline stocks will become so heavy again they will depress prices and cut realizations (see p. 196).

But if refiners are lucky enough to get a good early motoring season to keep gasoline demand high following an improved winter business, they can keep their plants in the black.

Price Adjustments Continue

. . . in Texas, Oklahoma, and Kansas. Buyers trim prices by 3 to 7 cents a barrel to meet cuts of competitors.

OTHER major buyers adjusted crude prices lower last week in Texas, Oklahoma, and Kansas. Trends in each case had been set by earlier cuts.

The Texas Co. cut 7 cents a barrel off the price it pays for 40°-44.9°-gravity North Texas and Texas Panhandle crude.

New top price in North Texas is $3.01 a barrel. Top Panhandle price is $2.95 a barrel with a 3-cent differential for each degree below 40° gravity. Texaco buys about 43,000 bbl. daily in North Texas and about 13,500 bbl. daily in the Panhandle.

Texaco also cut its price on 5,000 bbl. daily of South-Central Texas sour crude by 7 cents a barrel. New top is $2.95 for 40°-gravity crude with a 3-cent downward differential.

Other Texas reductions:

. . . **Continental** cut 7 cents a barrel to $3.01 top in North Texas where it buys 20,000 bbl. daily.

. . . **Bell Oil & Gas** made same reduction on 7,500 bbl. daily in North Texas and 200 bbl. daily in Red River area.

. . . **Humble** dropped Texas Panhandle price by 7 cents to $2.95 top on 24,000 bbl. daily. Similar cuts were made on 15,000 bbl. daily purchased in Southwest Texas.

. . . **Magnolia** made the 7-cent cut in the Panhandle and North Texas, posting new tops of $2.95 and $3.01 respectively.

Meanwhile, the move to stabilize Oklahoma sweet crude at a $3.05 top gained ground.

Sunray Mid-Continent, largest buyer of Oklahoma oil, adjusted its price from a $3.08 top to the $3.05 price. The new schedule carries a 2-cent downward differential to 36° gravity and a 3-cent drop for each lower degree after that.

Continental also moved to the $3.05 top for Oklahoma sweet and made the same 3-cent reduction on Kansas crude. Conoco buys 13,000 bbl. daily in Oklahoma and 17,000 bbl. daily in Kansas.

Sunray's move followed a similar one by Indiana Oil Purchasing a week earlier. About 325,000 bbl. daily of Oklahoma crude now moves at the $3.05 top while 85,000 bbl. is left at the higher level.

Oklahoma crude prices in the last year have fluctuated from tops of $3.15 to $3.01. At one time as many as five price schedules existed.

Computer Installed

at Phillips' headquarters. It is IBM's biggest commercial unit. Four others on order.

THE FIRST IBM 709 electronic computer for oil-company use has been installed at Phillips Petroleum Co.'s Bartlesville, Okla., headquarters.

Phillips also is the first company to make use of the machine's special design to handle both technical and business calculations. It is being used in connection with accounting, operations control, data analysis, and research.

The 709—the largest type of electronic data processing machine in commercial use—is made up of 33 units which take up 4,000 sq. ft. of floor space.

Phillips says use of the equipment will lead to more efficient operation of pipelines, producing properties, and plants; improved motor-fuel blending; closer control of warehouse stocks; and more rapid and accurate design of equipment, solving of research problems, and preparation of reports.

Three other oil companies have the giant computers on order. Shell Oil Co. is having the machines installed in New York and at its Emeryville Research Center for research work. Standard Oil Co. (N. J.) plans to replace an IBM 704 at Linden, N. J., with a 709. The Texas Co. has one ordered for its Houston center for technical calculations.

Humble plans . . . Humble Oil & Refining Co. this spring will acquire an analog computer system manufactured by Mid-Century Instrumatic Corp., New York.

The computer will be installed at Humble's Baytown, Tex., refinery. It will be used in operations control and research and development of new processes.

Offshore Line May Expand

A FEDERAL Power Commission examiner has approved plans of Transcontinental Gas Pipe Line Corp. to expand its offshore gas-gathering system.

New facilities, costing about $2,135,000, will permit Transco to receive additional gas from Block 71 and Block 76 fields off Louisiana's Vermilion Parish.

The examiner also approved sale of the gas by Superior Oil Co. at an initial price of 21.4 cents per M.c.f. United Gas Improvement Co., Philadelphia, and Public Service Commis-

sion of New York had sought to condition the sale to an initial rate of 17 cents.

Transco previously had contracted for about two-thirds of the gas reserves in the two fields at an initial price of 21.4 cents. The price was approved by the FPC last September. Total reserves to be acquired from Superior are estimated at about 1 trillion cubic feet.

Transco's new construction program includes two 16-in. laterals totaling about 15 miles and a shorter 12-in. line.

Probes Threatened

by Texas governor of price cuttings and high imports.

GOV. PRICE DANIEL of Texas last week threatened to go on the warpath in earnest against importers.

Incensed at the inroads he feels imports are making in the state's petroleum- based economy, Daniel warned of state antitrust investigations or other action if crude-price cutting and import gains are not halted.

Texas, Daniel said, is losing at least $6,000,000 yearly in tax revenue due to the crude-price cuts imposed by crude buyers in the state in the past 16 months. He blames importers for making most of these cuts.

On top of this, he said, the price reductions have cost the public school and University of Texas permanent funds more than $1,000,000 during this time in royalty payments.

The state is being deprived of still another $12,000,000 annually in tax revenue due to lowered crude-oil allowables due to excessive imports, Daniel said.

He noted that counties, cities, school districts, and other local taxing units are losing just as much on oil-tax income as the state.

"If the two-pronged attack (imports and price cuts) on our economy and the resulting loss of state revenue is not halted, I shall ask the attorney general and the oil imports study commission to investigate for possible antitrust violations and any other means by which the economy and revenues of the state may be protected," the governor said.

The time has come, he said, when the state government must do everything in its power to protect itself against declining crude prices and spiraling imports.

"I appeal now for application of business statesmanship to stop the present disastrous trends before it is too late."

Right-of-Way Leases Due

. . . in Texas despite protest by oil operators. New board created to handle leasing may hold first sale in April.

TEXAS operators have failed in their bid to stave off leasing of mineral rights under many highway rights-of-way in oil and gas-producing areas.

This became clear last week with the creation of a new state board called the Texas Board for Lease of Highway Department Lands.

Members of the new three-man board are Bill Alcorn, state land commissioner; Marshall Formby, highway commissioner; and John Ben Shepperd, former attorney general. Alcorn will serve as chairman.

First offering of rights-of-way by the new board may come April 7, the date already set for a sale of leases on state school lands. In one of its first official acts, the board asked Formby to submit specific tracts for bids. These must be in to the board by March 5.

The highway commission in Texas has said that it owns mineral rights on about 211,000 acres of right-of-way. About 26,000 acres of this total is in oil-producing areas. The commission bought this right-of-way prior to 1943. Since then it has purchased only surface rights.

The strips of land involved cross many of the prolific older fields in Texas, such as East Texas field.

Chaos predicted . . . The new board was set up over the strong protests of the state's oil industry and other unrelated groups (OGJ, Nov. 10, 1958 p. 102).

These included the Texas Good Roads Association; the Fort Worth, Texas, and Southwestern Cattle Raisers Association; and the Texas Farm Bureau.

The highway commission held two hearings on the advisability of taking such action before it actually moved. One was held in early March 1958 when proponents of right-of-way leasing were heard. The opposition was registered in a second hearing November 1.

The opposition, spearheaded by Texas Mid-Continent Oil and Gas Association, said leasing of rights-of-way in fields already developed could reduce operations in such fields to a chaotic state.

Wells drilled on such narrow strips of land could not possibly recover their investment unless they were permitted to drain oil from under adjoining leases. Producers on adjacent leases in many cases would be forced to drill many unnecessary wells to try to minimize drainage, upsetting long-established and orderly spacing patterns.

In unitized areas, such leasing would be utterly disastrous, opponents argued. Under Texas law there is no way that unit operators could force highway strips into the units.

At last count, Texas Mid-Continent pointed out, there were 9,500 wells connected to recycling and pressure-maintenance plants in Texas. Such projects and other secondary recovery programs would be severely harassed and perhaps destroyed if the commission proposal were carried out.

Besides being unwise because of the certain inequities and waste of hydrocarbons, right-of-way leasing likely would not be legal, opponents argued.

Past opinions by the attorney general's office indicate this to be the case. Texas Mid-Continent's spokesman also cited a 1954 court decision wherein mineral rights were returned to the adjoining landowner, the original minerals owner, on evidence that the lease was granted on condition that the land be used for highway purposes only.

Endless litigation, opponents said, would follow any department effort to grant leases based on its questionable mineral-rights ownership.

Stand reversed . . . Formation of the new lease board came as an unpleasant surprise to the Texas oil industry.

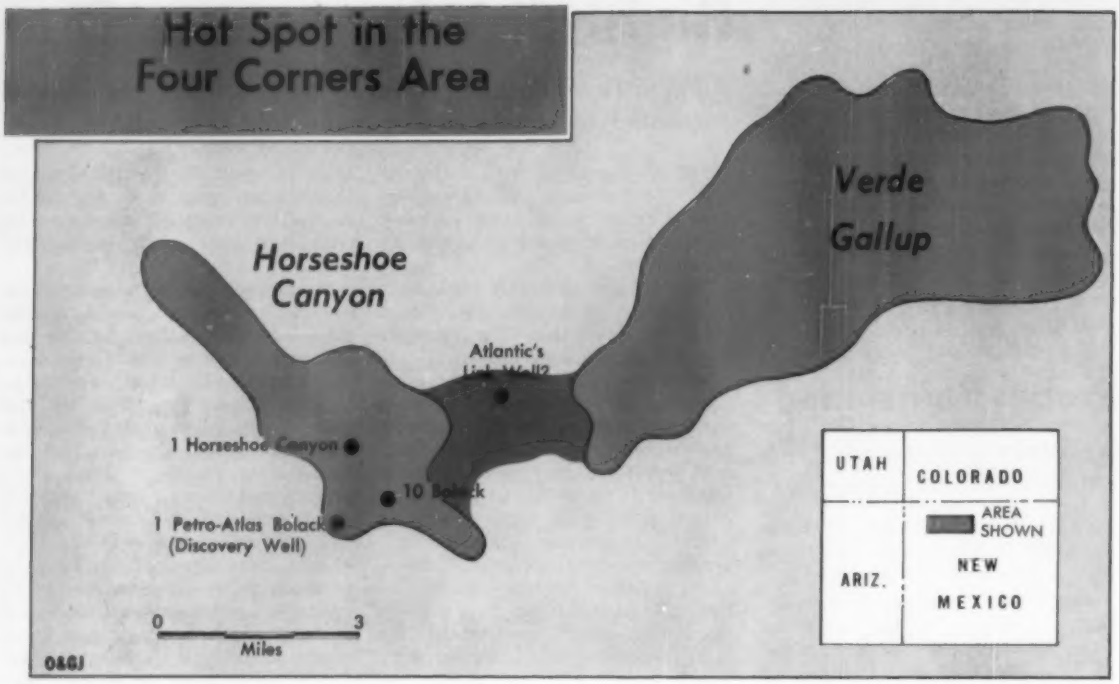
It represents an apparent complete reversal of the intentions of the highway commission as expressed by that agency last November.

Following the November hearing, the industry felt it had the assurance of the commission that it would hold off leasing until the Texas legislature specifically authorized it to lease.

A highway-department spokesman said at the hearing that the department had no intention of permitting drilling on rights-of-way or of attempting to resume buying mineral rights.

"The people, however, own these mineral rights and it is felt that any oil coming from under this right-of-way belongs to Texas taxpayers."

He said he felt some settlement could be worked out fair to all "so that the state can be paid for the oil taken from under the highway rights-of-way by wells on adjoining property."



Shallow Play Hits Four Corners Field

• Operators are making hole fast and getting good wells in the Gallup and Tocito zones in New Mexico's Horseshoe Canyon field. Atlantic and El Paso are leading the pack in a fast-moving development program.

HORSESHOE CANYON field, eyed skeptically for some time by many Four Corners operators, has become the hottest drilling area in northwestern New Mexico.

The play has been sparked by two shallow pays, the Gallup and Tocito of Cretaceous age. Drilling is easy, and the wells consistently flow at rates above 100 bbl. a day.

Atlantic Refining Co., one of the slow starters in the field, has punched down 20 wells in the past few months. It expects to keep on drilling until development of its acreage is complete or until it runs out of pay zone.

El Paso Natural Gas Co., another large acreage holder in the field, also is drilling its properties at a fast clip.

Rapid development already has ballooned proved acreage in Horseshoe to about 6,000 acres with more than 80 wells. And most of this drilling has taken place within the past year.

Horseshoe hit the headlines recently when Tom Bolack reported a flowing potential of 3,012 bbl. daily from his 10 Bolack in 10-30n-16w. Other field operators feel, however, that the well isn't nearly so large as indicated since the pay is similar in thickness and other characteristics to that found in other nearby wells.

Full of surprises . . . Horseshoe Canyon is one of the most northwesterly fields in New Mexico. It lies on the northwest rim of the San Juan basin 18 miles northwest of Farmington and about midway between Hogback oil field and Barker Dome gas field.

The tip-off to the discovery was a well drilled by Bolack 6 years ago in the southwest quarter of 9-30n-16w. Bolack recovered "a couple of bucketsful of free oil in the Gallup zone," drilled on to the Dakota, and lost the hole when he found flush water production in that formation. This dry hole is about a mile west of the field's discovery well.

There was no further action until Arizona Explorations, Inc., Dallas, took a farmout from Bolack in 1956 and in June that year completed its 1 Petro-Atlas Bolack, ¾ mile to the east in the same section for about 30 bbl. a day from the Gallup.

Arizona Explorations says low production of this well was due to a faulty frac job. The fact remained, however, that its production was too small to get many producers excited.

Things began to perk up when Arizona Explorations completed its 1 Horseshoe Canyon 2 months later, 1½ miles to the north in Section 4, for more than 100 bbl. a day from the Gallup from 1,150-1,220 ft. and the Tocito from 1,290-1,326 ft.

The real drilling upshoot, however, came with completion by El Paso Natural Gas Products Co. of a pipeline into the field in May 1958.

Link up with Verde? . . . Of the two pays, the lower Tocito zone is the more attractive. Though separated by only 60 ft. of impervious shale, the two zones are quite different.

The Tocito is a long, narrow marine-type bar of sand now proved about 6 miles long and only about a mile wide. Porosity and permea-

bility are excellent and uniform. The pay, roughly 35 ft. thick in the center, thins rapidly to the flanks.

The Gallup on the other hand is typical Gallup—shaly, tight, and with erratic permeability and porosity.

Both are strat traps. But the Gallup, rather than being narrow, is sprawling out both northeast and southwest of the field's northwest-southeast trend.

It is virtually certain now that Horseshoe's Gallup pay will prove to be a common reservoir with Verde Gallup field about 2½ miles to the northeast. Atlantic recently completed a Gallup producer halfway between the two fields in 36-30n-16w, which appears to furnish clinching evidence of the connection.

Verde Gallup, which now boasts about 100 Gallup wells, does not produce from the Tocito zone.

Horseshoe operators think the more prolific Tocito zone will pinch out shortly at both northwest and southeast ends.

Both zones dip rapidly going into the basin to the southeast. Bolack's No. 10, for instance, found the Gallup at about 1,600 ft.—several hundred feet deeper than at Arizona Explorations' 1 Horseshoe though only about a mile to the southeast of this well.

Drilling fast . . . The average Horseshoe well is drilled in only 4 days—with about 10 days the average for completion. This includes making the surface hole, setting surface casing, drilling, setting production string, perforating, fracturing, and putting the well on production.

Fracture treatments have used lease crude with volumes ranging up to 60,000 gal.

Drilling is relatively easy, with only scattered instances of crooked hole trouble due to boulders in shale formations near the surface.

Reserves estimated . . . Arizona Explorations estimates oil in place in the Gallup zone in Horseshoe at about 500 bbl. per acre-foot and in the Tocito at about 900 to 1,000 bbl. per acre-foot.

The company emphasizes, however, that little production history is available on which to base estimates. It feels these early figures likely will prove conservative.

Both zones apparently produce via solution gas drive. Arizona Explorations feels secondary-recovery prospects are relatively poor in the Gallup but very good in the Tocito. Preliminary estimates place total primary-secondary take from the Gallup at about 15 to 20% of oil in place but perhaps as much as 60% from the Tocito.

Esso May Build Atom Tanker

. . . in joint Government project. Esso would pay cost of conventional ship, if U. S. pays for nuclear equipment.

THE WORLD'S first nuclear-powered tanker may be built and operated by Esso Standard Oil Co.

John J. Winterbottom, Esso vice president, told the joint congressional committee on atomic energy last week that Esso would be willing to cooperate with the Government on such a project.

Esso offered to pay the costs of building a conventional tanker, with the Government absorbing the additional cost of the atomic propulsion equipment.

Esso is now building two 47,000-deadweight-ton tankers at Newport News, Va., at a cost of $13 to $15 million each. One of these or a similar hull could be adapted if the offer is taken up in the near future.

Winterbottom made it clear that Esso is not advocating construction of the atomic-powered tanker immediately but is willing to cooperate with the Government when and if the committee thinks the time is proper.

The company proposed also that fuel costs later be apportioned on a similar basis and that insurance be made available by the Government to the extent that it could not be obtained from commercial sources at reasonable costs.

Winterbottom hailed the Government's building of the first nuclear merchant ship, the Savannah, as a "great contribution in the field of nuclear propulsion." The next logical step in the atoms for peace program would be the building of a tanker for private ownership and operation under the American flag.

Texas Cuts Crude Allowable

. . . for this month to 3,138,565 bbl. per day. Commission sets 12-day producing schedule following brief hearing.

IN THE SHORTEST allowable hearing in months, The Texas Railroad Commission February 20 put Texas crude on a 12-day producing pattern for March.

Its action cuts the state allowable to 3,138,565 bbl. daily this month—down 56,261 bbl. daily from the initial allowable for February and 21,667 bbl. daily from that in effect February 7.

Purchasers' needs for March crude were unusually similar. All recommendations but one were for either 11 or 12 days. Gulf Oil Corp. with its huge Port Arthur refinery idled by a strike, tentatively nominated for only 4 days.

On the high side with 12 days were: Magnolia, Indiana Oil Purchasing, Texaco, Humble, and Atlantic. Seeking an 11-day schedule were: Shell, Sun, Cities Service, Sinclair, Phillips, Standard of Texas, and Continental.

Shell jacked up its nomination substantially with the resumption of full-scale operations at its strike-bound Wood River, Ill., refinery.

Sinclair's nomination was pared due to a planned refinery turnaround.

ALLOWABLES BY DISTRICTS

District—	March	Change from February 7
1—Southwest	55,113	+ 178
2—Gulf Coast	127,893	— 1,423
3—Gulf Coast	408,769	— 2,498
4—Southwest	218,489	— 855
5—East Central	35,965	— 226
6—Outside East Texas field	136,253	— 1,757
6—East Texas field	161,615	— 3,376
7-B—North Central Texas	186,572	— 982
7-C—West Central Texas	153,053	— 919
8—West Texas	1,226,654	— 8,514
9—North Texas	281,886	— 1,488
10—Panhandle	146,303	+ 193
Total	**3,138,565**	**—21,667**

Louisiana's Record-Breaking Offshore Lease Bids

Tract No.	Block	Company	Bonus bid	Average per acre	Acres
ST. MARY PARISH (All tracts in Atchafalaya Bay. Not listed by blocks)					
7452	...	Union	$431,376	$563	1,522
7453	...	Union	531,376	290	3,667
7454	...	Delhi-Taylor	766,909	403	1,903
7455	...	Magnolia	1,877,750	503	3,750
7456	...	.....	All bids rejected		1,903
7457	...	Superior	851,625	454	3,750
MAIN PASS AREA					
7458	55	Pan American	706,066	614	1,150
7459	54	Pan American	802,750	214	3,750
7460	65	.....	No bids offered		1,025
7461	66	Pan American	1,782,100	487	3,656
7462	83	Shell	2,001,200	527	3,800
7463	84	Pan American	717,822	211	3,402
7464	85	.....	All bids rejected		3,232
VERMILION AREA					
7465	8	Humble	1,124,550	525	2,142
7466	13	Humble	1,458,450	525	2,778
7467	6	Humble	830,025	225	3,689
7468	7	Humble	*851,025	348	2,449
7477	28	Shell	152,000	100	1,525
7478	27	Pan Am, Union	721,775	577	1,250
GRAND ISLE AREA					
7479	25	Hunt Oil	156,400	111	1,409
EUGENE ISLAND AREA					
7469	5	Union	81,025	463	175
7470	6	CATC Group	363,917	404	900
7471	7	Shell	6,000,100	3,000	2,000
7472	8	Shell	2,000,000	800	2,500
7473	1	.....	No bids offered		4,340
7474	2	.....	No bids offered		4,235
7475	3	Gulf, Humble	†1,031,000	452	2,283
7476	4	Gulf, Humble	4,846,000	1,006	4,815
SOUTH PASS AREA					
7480	27	General Amer.	1,696,132	1,501	1,130
WEST CAMERON AREA					
7481	3	Superior, Pure, Sun	32,651	75	435
7482	3	Superior, Pure, Sun	100,216	110	911
WEST DELTA AREA					
7483	50	.....	No bids offered		1,435
7484	50	Calco, Zapata	28,503	63	1,040
7485	24	Gulf, Humble	3,031,000	1,420	2,135
7486	23	Gulf, Humble	1,031,000	573	2,987
7487	4	Union	257,400	110	2,340
IBERIA AND ST. MARY PARISHES (North of Blocks 3 and 4 in Eugene Island area)					
7488	...	Sunray, Skelly, Tidewater	100,200	167	600
7489	...	.....	No bids offered		1,300
EAST CAMERON AREA					
7490	2	Phillips, Kermac, J. Ray McDermott	3,660,426	1,376	2,660
7491	3	.....	No bids offered		4,550
7492	9	D. D. Herrington, Amarillo	60,000	100	600
7493	16	Shell	2,002,500	2,488	805
7494	17	TGT	1,487,712	1,566	950
7495	23	Shell	75,000	300	250
Total			$43,658,080	652	66,938

*Humble split the tract in two and bid successfully on both. Figures are for the two combined. †All of Block 3 was offered. Gulf-Humble bid successfully on east half. No award on west half.

Bonus Bids Brighten Drilling Outlook

• Louisiana's surprising lease sale — smashing all records and bringing in $61,480,000 — assures stepped-up offshore and inland drilling. The big payments prompted officials to consider another sale for July.

IF THERE was ever any doubt that offshore drilling in Louisiana was due for an upturn, that doubt is now erased.

Surprising Louisiana officials and much of the oil industry itself was the record-breaking lease sale that brought into the state coffers $61,480,000 in bonus payments and a guarantee of heavy new drilling, both offshore and inland.

The offshore tracts brought as much as $3,000 per acre and an average of $652.21. The $3,000 figure is a record for offshore Louisiana acreage. And the $61,480,000 figure is tops for a single sale.

Who won . . . It was Shell Oil Co. that made the $3,000 bid, and it was Shell that paid the most in bonuses—some $12,240,000.

The other big winners in the sale were Humble Oil & Refining Co., Gulf Oil Corp., and Pan American Petroleum Corp. Humble paid $4,265,000 and shared with Gulf in $9,940,000 more. Pan American paid more than $4 million.

The bidding was heavy at the sale in Baton Rouge. The CATC Group lost one heart-breaker when its bid of $4,843,217.34 turned out to be just $2,782.66 shy of the $4,846,000 offer of Gulf-Humble. This was on Block 4 in the Eugene Island area.

Shell's $3,000 per acre bid cost a total of $6 million for 2,000 acres in Block 7 of the Eugene Island area. Production is nearby. Shell also paid $2,487.58 per acre for an 805-acre tract in Block 16 of the East Cameron area, also near production. The tract, nominated by the Louisiana Mineral Board, brought slightly over $2 million.

The Mineral Board leased some 36 offshore tracts and 88 inland tracts. However, those offshore brought $43,658,000, while those inland added only $17,822,000.

Offshore tracts totaled 66,938 acres and the inland ones 91,275.

The board rejected all bids on two offshore tracts and received no bids on six others.

All the tracts were in Zone 1—

within 3 miles of the Louisiana coastline and thus under state control.

Drilling ahead . . . Terms of the lease sale virtually guarantee an active drilling campaign on the part of the successful bidders.

Most of the lease contracts require drilling the first year. Otherwise, the lessees must pay a rental of one-half the bonus. Most of the leases are for 5 years, and the drilling-rental terms apply for each year, or the leases revert to the state.

Inland tracts generally were for 3 years.

Most of the successful bidders offered the state the usual one-sixth royalty, although one tract went to a company because it offered one-fifth. Delhi-Taylor Oil Corp. was outbid by Humble, $800,010 to $766,909, on a 1,903-acre tract in Atchafalaya Bay, but the Mineral Board accepted the Delhi-Taylor offer because of the higher royalty.

Sale policies . . . The success of the sale apparently proved the value of the Mineral Board's policy of stopping leasing last summer, when bids on inland tracts were far below expectations.

By adding offshore tracts this time—the first in 3 years—the board created unusual interest and received an enormous number of bids.

The board tentatively set another sale for July, possibly July 16, and there was some indication that the federal Government may join with Louisiana in offering Zone 2 tracts further offshore in the near future.

The big bonus payments helped to get Louisiana state government out of a financial jam caused by the lack of bonus income during the last half of 1958.

Drilling Barge Christened

A SUBMERSIBLE drilling barge for use in Louisiana's inland waters was commissioned last week at Orange, Tex., by Levingston Shipbuilding Co. and Bay Drilling Corp.

Bay will put the barge to work shortly near Houma, La., on a contract drilling project for Superior Oil Co. The barge, second for Bay, was christened the "Rome."

Designed for drilling in waters 9 to 12 ft. deep, the barge can drill to 20,000 ft.

It is 190 ft. long and 50 ft. wide and has a 14-ft. hull. It is a slotted hull-type steel submersible vessel with a derrick substructure and superstructure erected above the main deck to support the derrick, drilling machinery, pipe racks, and quarters.

watching WASHINGTON

Joe Reilly

• FPC to tackle significant gas cases

IN THE NEXT FEW WEEKS the Federal Power Commission will consider some controversial rate cases which may have long-lasting effects on wellhead gas prices.

Three important rulings by three different examiners are now pending FPC review. In each case, the examiner has taken the liberty of setting policy which would tend to depress field prices. The question is whether the commission, which is traditionally more conservative than its own staff, will go along with the new policies.

Oral argument will be heard March 17 in one case involving the right of a pipeline company to take advantage of the depletion allowance and intangible drilling costs for its own production.

A December 17 ruling by Examiner Daniel J. Kelly would deny such benefits to United Fuel Gas Co. If the decision is upheld, the company will be required to reduce its wholesale gas rates by some $2,818,000 a year. Refunds would be retroactive to January 1, 1956.

If the pipeline company is denied the benefits of depletion and intangible drilling costs in setting its rates, the same policy easily could be extended to independent gas producers. The commission itself deferred action on the question in October 1956 when it approved a settlement of other issues in United's rate case. Now, Examiner Kelly has decided that such tax deductions are "windfalls" to which pipeline companies are not entitled.

IN THE OTHER TWO CASES, THE SUPREME COURT may play a more important role than the FPC.

Now before the commission is the recent ruling by Examiner Richard N. Ivins against Panhandle Eastern Pipe Line Co. The decision, if allowed to stand, is expected to cost Panhandle between $7,000,000 and $11,000,000 a year, retroactive to January 1, 1955.

One of the chief questions to be answered is whether Panhandle is entitled to the going field price for its own gas production. Ivins computed the rate on the cost of production. He figured this was about $5,000,000 a year below the weighted average field price.

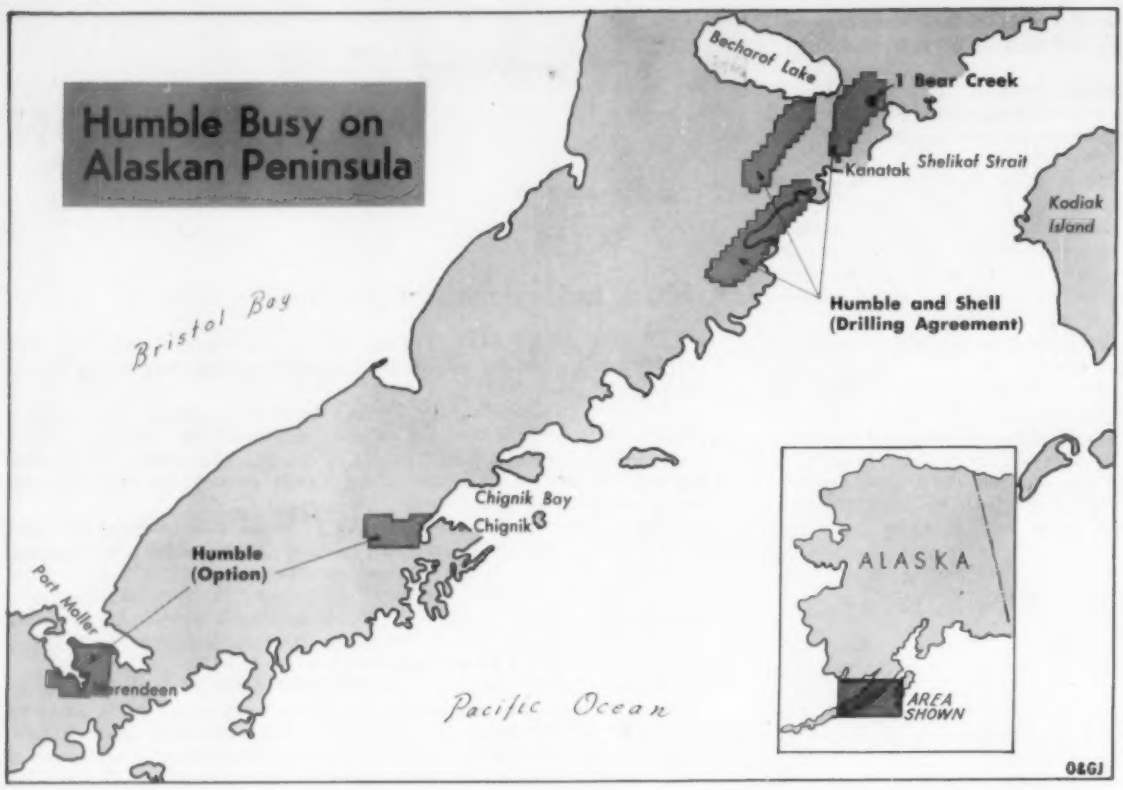
The examiner noted that the FPC previously had allowed Panhandle to use the "field price" approach, but that the order was reversed by a circuit court of appeals. The Supreme Court refused to review the decision.

WILLIAM J. COSTELLO, ANOTHER EXAMINER, BROUGHT before the commission the old subject of conditional certificates in last month's ruling on gas rates in Bell Lake field of southeastern New Mexico.

His order would authorize four producers to sell gas to El Paso Natural Gas Co. provided they accept 13.348 cents per M.c.f. instead of the contracted rate of 16 cents. The producers are Continental Oil Co., Shell Oil Co., Phillips Petroleum Co., and Humble Oil & Refining Co.

Costello considers the lower price an "interim" rate. Other El Paso suppliers are seeking the same price in separate cases pending before the commission. But Costello expressed the fear that approval of the 16-cent price might set off a general move for higher rates in the Permian basin.

In several previous cases in which a specific field price had not been determined to be just and reasonable, the FPC has granted sales certificates without rate conditions. The practice has been challenged in court several times. One of the cases, involving offshore gas sales by the CATC Group, recently was accepted for review by the Supreme Court.



Humble Looking Hard for Alaskan Oil

• Five summers of exploratory work and 17 months of drilling are giving this Jersey affiliate valuable information on Alaska's oil potential. The company's only wildcat is now drilling below 1,300 ft. on the Alaskan Peninsula.

ALASKA has yet to prove itself a great oil province. But if and when it does, Humble Oil & Refining Co. should be among those who submit the proof.

As one of the big operators in the new state, Humble has spent a lot of money during the past 5 years exploring Alaska's geology and drilling one expensive well. The payoff for this spending is years away, if it ever comes. But Humble should have comfortable quarters on the ground floor if today's oil rush is even moderately successful.

Humble's drilling well is on the Alaskan Peninsula, but the company's geology crews have been conducting reconnaissance and doing surface mapping in several parts of Alaska.

Traditionally, surface geology has been one of the least expensive methods of hunting for oil. This does not hold in Alaska.

The bush country—that vast roadless area of mountains, tundra, and glaciers—presents major problems in planning and logistics. Aerial transportation becomes a virtual necessity.

During the summer of 1958, for example, Humble had 10 helicopters in operation in Alaska.

Two of the company's exploration parties roamed the forests and foothills south of the Alaska Range in South Central Alaska, just north of Kenai Peninsula, site of the state's only commercial field.

Toward the end of last summer, the two exploration parties joined forces at Beluga Lake. During their 4 months of geological scouting last year, the parties covered about 20,000 sq. miles.

A third team last summer confined its exploratory activities to a part of the Yukon basin.

Seismic work . . . Humble also is conducting seismic activities out of a base camp at Willow, a small trading post north of Anchorage.

Two company geophysicists, a 13-man party working on contract, and a five-man helicopter crew are taking part in the operation.

For the first time helicopters are being used as the only prime movers on a Humble seismograph job. The helicopters make seismic work expensive. Shooting a location may cost two or three times more than a similar project along the Texas Gulf coast.

P. F. Sollars is Humble's geologist in charge of exploration work in Alaska. His office is at Anchorage.

Carsey's views . . . J. Ben Carsey, Humble's exploration adviser, holds realistic views on the cost of doing business in Alaska.

Carsey recently told the Houston Geological Society that exploration and drilling costs will be two to three times what they are in the other 48 states. If oil is found, this also will apply to production and transportation.

Pipeline costs for oil found in north-

ern Alaska, for example, would hit at least $1 per barrel, and there would be another 30 to 40 cents per barrel for shipping it to the U. S. West Coast.

This means that Alaskan oil would not bring more than about $1.50 to $2 per barrel at the wellhead in fields any great distance from Alaska's south coast.

Kanatak test . . . Carsey's knowledge of drilling costs stems from Humble's own experience.

The drilling crew at the site of the Humble-Shell Bear Creek 1 has been working since September 23, 1957. The site in the Kanatak area of the Alaska Peninsula was selected after four summers of exploratory work.

Drilling on the isolated peninsula has been costly and difficult. One year after the well was spudded the bit had reached a depth of only 12,062 ft.

Results of the drilling have not been encouraging to date. No oil or gas producing zones have been discovered, and the projected depth of 12,500 ft. has been extended indefinitely. Last week the rig was drilling below 14,374 ft.

A significant part of the time spent drilling the Bear Creek well has been consumed by a long and costly fishing job.

Fishing started last April when a string of 21 drill collars was lost in the hole. After 5 weeks the crew retrieved all but one of the massive joints, but the bottom collar could not be budged.

Attempts then were made to sidetrack the stubborn collar. Seventeen whipstocks were set but each time veered off at too great an angle or came back into the hole. Finally, after 16 weeks of trying, the hole was sidetracked.

Weather has presented major problems at Bear Creek. During the first 6 months of drilling, for example, gales of 75 m.p.h. were recorded 31 times. Velocity hit 100 m.p.h. 11 times.

Rain and low temperatures have plagued the drillers, too.

Holdings . . . While Humble's exploratory activities range wide over Alaska, the company so far has concentrated its holdings and option contracts on the Alaska peninsula.

Humble has drilling agreements or options on well over 500,000 acres in five areas on the peninsula.

In the Kanatak Bay sector, Humble and Shell Oil Co. have a drilling agreement on three areas. Humble is earning a one-half interest.

To the southwest in the Chignik Bay sector, Humble has an option agreement on another area which, like Kanatak, is on the east edge of the peninsula.

Still further to the southwest, on the western side of the peninsula, Humble has an option on additional acreage around Port Moller.

The job ahead . . . Humble's president, Morgan J. Davis, says the industry is a long way from finding the real oil potential of Alaska.

In 57 years, according to Davis, scarcely more than 100 exploratory wells have been drilled in Alaska. Contrast this with the fact that the Gulf Coast area of the U. S. has three times that many wildcats drilled in a single month, and the magnitude of the task is apparent.

Davis also is concerned with the high cost of doing business in Alaska. He told an Anchorage audience last year that the Bear Creek well may cost several times the cost of an average $585,000 offshore well.

Since Davis made the speech, some 6 months have passed, and the Bear Creek well is still making hole.

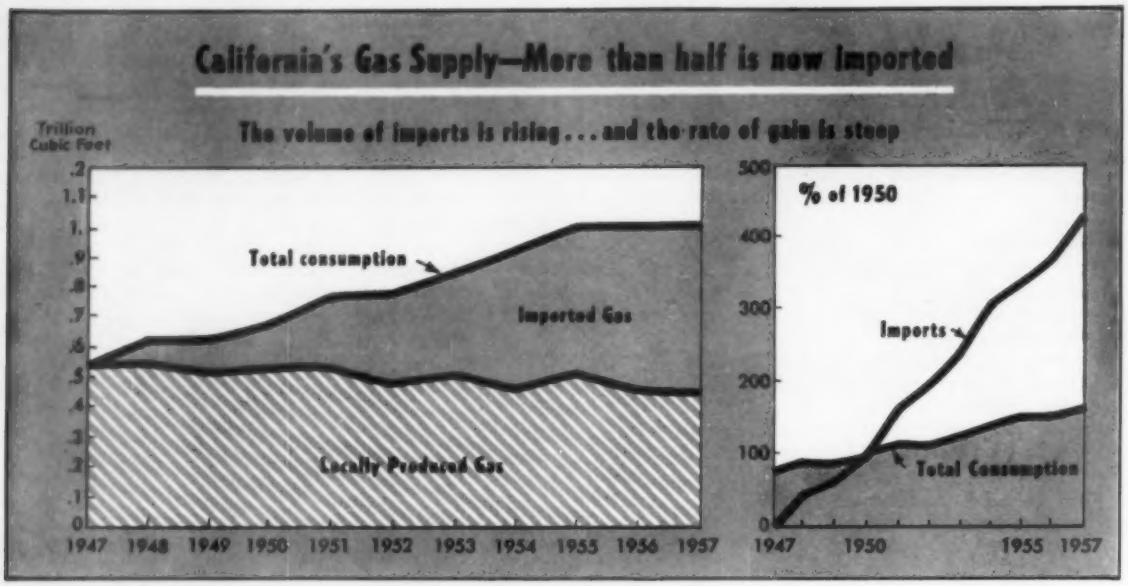
LIGHT enough to float—and one man to lift—it's . . .

Rope Made of Polypropylene

SINCLAIR Petrochemicals, Inc., is sold on a new use for propylene—conversion into a lightweight polypropylene rope.

Sinclair installed a polypropylene hawser on its tanker, "S.S. Sinclair Superflame," and reports it withstood hurricane-force winds in port while conventional rope hawsers were cast off.

Sinclair Petrochemicals, a subsidiary of Sinclair Oil Corp., sells the propylene to Hercules Powder Co., which converts it into polypropylene. The polypropylene is made into rope by American Manufacturing Co. Marine department officials at Sinclair report the rope is light enough to float, does not absorb water or freeze, and is easy to handle. American Manufacturing officials say it has superior gripping power, resists kinking, and has resistance to rotting from solvents, greases, and water.


California's Gas Supply—More than half is now Imported
The volume of imports is rising . . . and the rate of gain is steep
Trillion Cubic Feet
Total consumption
Imported Gas
Locally Produced Gas
1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957
% of 1950
Imports
Total Consumption
1947 1950 1955 1957

California: Growing Market for Gas

• Up to now, El Paso Natural has been the sole supplier from outside the state—and has been pushed to get enough gas. But others are now working to get a foot in the door and take over some of the growing demand load.

"I'VE GOT the best market in the country," Paul Kayser, president of El Paso Natural Gas Co., used to say of California.

The growth in out-of-state shipments of natural gas bears him out. California consumption increased 60% from 1950 to 1958. But gas imports in the same period increased more than 300%.

Others besides El Paso have been impressed by this growth trend. They have tried for years, and are still trying, to get a piece of "the best market in the country."

El Paso's excellent service to booming California is the principal reason that the company has grown from a small local and regional supplier into the nation's largest gas-transmission company. The state's soaring appetite for out-of-state natural gas arises from three factors:

. . . **Population and industrial** growth which is the fastest in the nation, stimulating demand accordingly.

. . . **Declining state gas** production which requires imports to fill this gap as well as supply all new demand.

. . . **Pressure to reduce smog** in the Los Angeles Basin which is forcing natural gas into uses which would normally be met by fuel oil.

Where Californians Get Their Gas

(Millions of cubic feet per year)

	Locally produced	Imported	Total consumption
1947	544,950	3,432	548,382
1948	552,055	65,560	617,615
1949	525,224	94,099	619,323
1950	535,885	148,039	683,924
1951	544,099	243,749	787,848
1952	494,846	297,674	792,520
1953	505,135	357,108	862,243
1954	473,694	460,240	933,934
1955	513,238	507,157	1,020,395
1956	469,632	551,370	1,021,002
1957	456,785	634,451	1,091,236

New California supplier . . . El Paso has entered the billion-dollar corporation class quickly because it has been up to now the sole supplier of California gas imports.

This enviable position appears to be at an end.

Transwestern Pipeline Co. expects its 1,809-mile system from Oklahoma and West Texas to the California border to be approved this spring or summer. Hearings on its application will reopen this month before the Federal Power Commission. The measure of Transwestern's confidence is the fact that it has ordered all pipe for the line—some 400,000 tons—delivered by June 30.

But Transwestern, formed by Warren Petroleum Corp., Monterey Oil Co., and J. R. Butler & Associates, Houston, was not the first to be drawn to California.

Others tried before and are even now trying to put together a supply to serve a portion of the market which

has kept El Paso scrambling to get enough gas to keep up with demand—and to convince FPC its reserves were adequate.

Transwestern is now about to relieve El Paso of part of its "burden."

Latest contender . . . The latest attempt to get into California has been made by Tennessee Gas Transmission Co.

Industry reports and testimony during recent FPC hearings mention Tennessee's offers to various producers for gas for California. Tennessee, according to these reports, would build a line and transport gas to the California border for Southern California Edison Co.

Edison would actually buy the gas directly from producers in Texas, trying to get around FPC control. This project is known as Gulf Pacific Pipeline. Producers with large uncommitted reserves, such as Pan American Petroleum Corp. and Humble Oil & Refining Co., have been approached.

The deal has blown hot and cold, at times seeming imminent and then lying dormant. One big gas sale did not go through because of the high asking price—25 cents an M.c.f.

Edison is interested in buying a firm supply for its own year-round use in steam electric plants. It has tried for years to get a supply independent of resale gas distributed by Southern California Gas Co. and Southern Counties Gas Co. of California.

It was thwarted in 1957 in its bid to build a 30-in. line to connect gas it had purchased within the state (OGJ, July 8, 1957, p. 79, and Nov. 4, 1957, p. 80). An attempt at a similar project is being made again. (See story on this page.)

The California Public Utilities Commission took the position in 1957, and has since, that the public interest is best served when industrial firms are supplied by existing distribution companies. Space heating is considered a priority service to which gas is diverted from customers such as Edison under interruptible contracts in the winter.

The interruptible industrial load is deemed essential to efficient, economical service to residential customers. But Edison persists in efforts to get its own firm supply. It maintains that it will have access through deals outside FPC control to Southwest gas which would not otherwise be available.

Southern California Edison intends to continue efforts in this direction anyway. Its new president, J. K. Horton, has a background of gas-industry experience as former vice president of Pacific Gas & Electric Co. His most recent assignment was organization of PG&E's Alberta-San Francisco project as president of Alberta & Southern Gas Co., Ltd.

Should the Gulf Pacific deal go through, it would have very interesting results: It would place in competition the two men who are regarded as the titans of the industry—El Paso's Kayser and Tennessee's Gardiner Symonds, whose company now serves New York and is about to enter Chicago.

Earlier efforts . . . Attempts have been made to build lines which would involve gas from Louisiana, Oklahoma, Mexico, and Canada, as well as the Permian basin and San Juan basin sources.

The California distribution companies themselves have approached Petroleos Mexicanos (Pemex) about buying Mexican gas in the Isthmus of Tehuantepec for a line more than 2,000 miles long. Another transmission company sought northern Mexico gas for its own line to California.

But Pemex has stated its intention to export no more gas beyond present commitments as a matter of national economic policy.

Edison was the center also of a plan by Pacific Northwest Pipeline Corp., now merged into El Paso, to bring Canadian gas into California. Pacific Northwest negotiated with Edison officials first about a line southward through California.

But Edison by itself couldn't take enough gas to justify a big-inch line. And the southern California distribution companies weren't interested in participating. So the scheme was dropped.

Pacific Northwest later failed to interest PG&E in Canadian gas for its northern and central California markets. PG&E, of course, hopes to supplement supplies from El Paso with its own line from Alberta which it is pushing before FPC and Canadian boards.

Competing fuels . . . The natural-gas boom in the postwar years has been at best a mixed blessing for some in the oil industry. It has come at the expense of traditional fuel-oil markets to a certain extent.

Nowhere is the competition more acute than in Southern California, where a fuel-oil oversupply and a summer smog ban on fuel-oil burning in Los Angeles County have brought the situation to a head. Hard-pressed oil men have taken the unprecedented move of opposing a project which would boost imports by 475,000,000 cu. ft. daily by 1964 (OGJ, Feb. 23, p. 82).

Gas would be delivered through Colorado Interstate Gas Co. and El Paso lines, which opponents argued would help to make California a one-fuel economy. Industrial customers and smog officials, on the other hand, are prodding distributors to bring in more gas.

Regardless of the outcome of this particular hearing, one thing is certain: "The best market in the country" will continue to grow.

Utility Firm Opposes Richfield Gas Line

THE FEUD over use of natural gas in California broke out again last week as a gas utility filed a complaint against a proposed Richfield Oil Corp. gas line.

Southern Counties Gas Co. asked the Public Utilities Commission to require Richfield to get a certificate of necessity for a planned line from San Joaquin Valley to a Southern California Edison Co. electric generating plant at Oxnard on the coast.

According to reports, Richfield plans to supply gas to Edison for boiler fuel exclusively. Southern Counties charged that such a practice would have a serious impact on availability and cost of gas to regular gas-company customers.

Southern Counties, in effect, charged Richfield was proposing to set itself up as a "gas corporation" as defined in the state's PUC Act. If Richfield is going to do that, Southern Counties said, it should be required to get PUC approval as the regular gas utilities must do.

"The gas company is required to meet tests of public convenience and necessity in connection with any pipeline operation of its own, and holds that the projected Richfield pipeline must be required to meet the same tests," a gas company statement said.

Southern Counties denied that the move against Richfield had anything to do with a recent action by California oil companies against a line Southern Counties and its sister company, Southern California Gas Co., want to build to bring in additional out-of-state gas (OGJ, Feb. 23, p. 82).

Three-Ring Approach to Imports Plan

• While both houses and cabinet fuels committee ponder controls, imports drop sharply to within quotas.

THE EXECUTIVE department has had its chance to solve the oil-imports problem. Now the legislative and judicial branches will have their say.

While the Cabinet Fuels Committee was forging a new imports policy last week, congressmen in both houses were rallying support for a bill to scuttle it.

At the same time, some of the major importing companies were preparing to challenge in court any controls which threaten to upset their competitive advantage over producers and refiners of domestic oil.

Long delay . . . The three-way tug of war now threatens to delay indefinitely any long-range solution to the imports problem.

If new control efforts get tied up in court, domestic producers may have

Both Crude and Product Imports Fell in January

CRUDE OIL—DISTRICT 5

(Thousands of barrels daily)

	Allocation January 1959	Actual January 1959	Actual December 1958
Bankline	2.3	0	0
Caminol	2.8	2.8	2.8
Century	1.5	0	0
Douglas	4.4	0	6.8
Edgington	2.8	0	4.6
Envoy	1.2	3.6	0
Fletcher	5.2	0	5.2
Golden Eagle	2.3	4.3	2.9
General Petroleum	23.9	25.5	21.5
Manespo	1.4	0	1.4
Macmillan	2.3	0	2.4
Mohawk	2.9	0	8.4
Palomar	0.5	0	1.0
Richfield	8.5	0	8.4
Rothschild	2.7	5.0	5.0
Shell	30.4	32.0	30.7
Signal	4.0	0	0
Socal Oil & Refining	1.0	0	3.5
Standard of Calif.	27.8	16.1	36.8
Sunland	2.3	0	0
Texaco	19.3	27.8	22.8
Tidewater	35.5	19.5	35.3
Union	11.6	14.6	8.6
U. S. Oil & Refining	7.5	0	0
Wilshire	17.0	10.5	25.8
Total	**221.1**	**161.7**	**233.9**

CRUDE OIL—DISTRICTS 1-4

(Thousands of barrels daily)

	Allocation January 1959	Actual January 1959	Actual December 1958
Atlantic	50.2	38.6	57.7
Aurora Gasoline	3.5	3.5	3.5
Bay Refining	2.7	6.5	5.5
Cities Service	27.8	36.7	30.5
Clark	2.0	0	0
Continental	5.0	5.0	2.0
Crown Central	4.3	2.2	4.3
Danaho	0.5	0.5	0.5
Delta	3.0	*9.0	*9.0
Dow Chemical	0.3	0	0
Eastern States	15.6	†45.3	†53.1
Gabriel	6.4	0	6.4
Great Northern	28.1	25.5	29.6
Gulf	95.1	92.7	96.7
Hess, Inc.	9.8	10.6	8.2
Ingram	3.5	7.0	3.8
International	10.5	10.5	12.5
Lakehead	0.3	0.4	0.3
Murphy Corp.	4.3	8.0	3.8
Northwestern	11.5	19.1	24.8
Ohio Oil	3.5	3.5	3.7
Phillips	10.2	6.7	10.3
Pure	5.0	0	6.1
Republic	4.0	4.0	5.0
Shell	6.4	1.7	12.0
Sinclair	53.0	57.7	53.0
Socony Mobil	57.2	56.0	55.1
Southwestern	2.5	12.4	12.0
Standard of Calif.	56.9	50.5	54.7
Standard of Indiana	25.4	25.5	25.2
Standard of N. J.	61.4	67.0	55.7
Standard of Ohio	7.0	0	11.6
Sun	43.0	41.2	50.5
Sunray Mid-Continent	5.0	5.0	3.6
Tennessee Gas	3.5	3.5	3.6
Texas Asphalt	2.0	2.0	2.0
Texas City Refining	4.0	4.0	3.3
Texaco	46.4	45.7	46.8
Tidewater	29.2	17.6	54.1
United	3.0	3.0	6.0
Total	**713.0**	**728.1**	**826.5**

*Estimated. †From Texas Railroad Commission.

UNFINISHED GASOLINE, OTHER UNFINISHED OILS

DISTRICTS 1-5

(Thousands of barrels daily)

	Average May-June 1958	Actual January 1959	Actual December 1958
Atlantic	5.7	3.8	3.5
Crown Central	5.6	5.6	15.9
Eastern States	12.3	*0	*0
Gulf	16.3	10.8	11.0
Hess, Inc.	25.3	25.4	25.9
Sinclair	7.4	7.5	6.1
Socony Mobil	19.7	14.5	21.9
Southwestern	4.1	7.9	4.0
Standard of Calif.	8.5	2.3	5.8
Standard of Indiana	24.8	14.9	17.6
Standard of Ohio	1.7	0	9.7
Texas City Refining	7.0	3.8	14.7
Texaco	13.8	18.8	14.6
Tidewater	20.0	14.4	23.4
Union	4.7	2.9	2.2
U. S. Oil & Refining	2.6	8.5	4.3
Total	**179.5**	**141.1**	**180.6**

*From Texas Railroad Commission.

Shaping Up

even less protection from foreign oil than was afforded them by the voluntary program in effect since mid-1957.

Despite its inherent flaws, the voluntary program suddenly regained some of its lost prestige last week. It had never been accepted wholeheartedly, either by big importers who thought it went too far or by independents who thought it didn't go far enough.

But as the old voluntary program was about to expire, majors and independents alike saw in it the passing of an era when they had enjoyed relative freedom from government control. Both groups had hoped to avoid such intervention, but in the end it became apparent they wouldn't settle for anything less.

Imports drop . . . Ironically, the administrator of the voluntary program revealed last week that crude imports had dropped well below their allocations.

Figures released by Capt. Matthew V. Carson, Jr., listed crude-oil imports for January at 889,800 bbl. per day. The total represented a sudden drop from the 1,060,400 bbl. daily reported for the preceding month. It reversed the year-end trend during which crude receipts had exceeded their 934,100-bbl.-per-day quota for 2 months in a row.

Imports of unfinished products also dropped sharply in January. Carson listed average daily receipts at only 141,100 bbl., compared with an allocation of 179,500 bbl. per day and a December total of 180,600 bbl. daily.

Close loophole . . . The January report came just as the voluntary program was being dismissed as a failure.

One of the chief complaints against the voluntary plan was that it did not cover finished petroleum products. Independents argued that importers were making a mockery of the program by boosting the flow of unrestricted products made from foreign crude.

This loophole is one which Sen. Joseph C. O'Mahoney (D-Wyo.) hopes to close. After a delay of several weeks, he has introduced his long-anticipated bill to control imports of both crude and products.

A companion measure was introduced in the House last week by Rep. Wayne N. Aspinall (D-Colo.).

O'Mahoney, who has frequently objected to the delegation to the President of the power to curb imports, would make the Secretary of the Interior responsible for administering the new program.

The secretary would determine the portion of crude and products demand "which may be imported consistently with the maintenance of a vigorous level of domestic petroleum exploration and development."

How it would work . . . Quotas would be set for 6-month periods, based on estimated domestic demand.

In general, quotas would go only to domestic refiners, with coastal plants getting no more than 40% of the total allocation. An exception would be allowed for a plant receiving foreign crude by pipeline and for certain other hardship cases.

The proposed legislation reflects the difficulty of establishing uniform controls, a problem which the cabinet committee had debated for months.

In its present form, the O'Mahoney measure would set a specific limit only on residual imports. Residual would be limited to 10% of the total domestic petroleum demand as determined by the Secretary of the Interior.

Violations of the act would be punishable by a maximum fine of $100 for each offense.

By singling out residual imports for special controls, O'Mahoney and Aspinall have invited the support of coal-state congressmen.

Shortly after the bills were introduced, coal interests announced the formation of a National Coal Policy Conference. One of the organization's announced objectives is action "to stop the dumping of residual oil" at the expense of coal. The group also will attempt to increase the depletion allowance for coal and to curb competition from natural gas.

The United Mine Workers, coal producers, coal-carrying railroads, and coal-using utilities are cooperating in the new drive to protect coal markets from imported oil and other competing fuels.

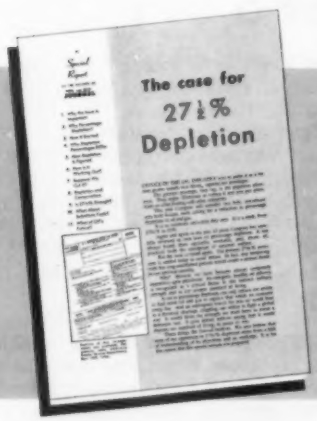
O'Mahoney also has appealed to Commerce Sec. Lewis L. Strauss to support the import bill. Strauss is chairman of the cabinet fuels committee, architect of import controls ordered by the President.

OCAW Sets Merger Agenda

OIL, Chemical, and Atomic Workers International Union and International Chemical Workers Union both will hold their 1959 conventions in Cleveland the week of October 5, with proposed merger the principal order of business.

A proposed constitution to prevail if the two unions are joined is now being prepared by the secretary-treasurers of both organizations.

The draft will be submitted to an eight-member committee on constitution for merger. When approved by this group, it will be submitted to a joint OCAW-ICWU merger committee at a meeting tentatively scheduled in Chicago beginning May 11.



Depletion Study Available

If your employes, stockholders, or acquaintances need a better understanding of percentage depletion, you can send them copies of the Journal's 16-page study, "The Case for 27½% Depletion," at nominal cost.

Reprints are being made available by the Journal as a service to the industry. Price is 20 cents each for fewer than 500, and 15 cents each for orders of 500 to 2,500. Larger quantities will be quoted on request.

Orders for the study, which appeared in the February 23 issue, page 99, should be addressed to:

Reader Service
The Oil and Gas Journal
Box 1260
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Arkansas Aids Producers

. . . faced with a high-cost, salt-water disposal problem. Tax relief to offset cost of pollution-control systems.

A SEVERE financial blow — an edict for southern Arkansas producers to stop dumping salt water into the Ouachita River basin—has been softened by the state.

Pollution - control measures must still be put into effect, but Arkansas has come up with a novel method to underwrite a good part of the costs.

A new law was passed to permit severance-tax relief to oil operators who install underground salt-water disposal systems. The operators will be given credit, against their severance tax, of the entire cost of installing the systems.

The state law snatched many of the small producers from the brink of financial disaster. Unable to shell out large sums of money for pollution abatement, they would have been forced out of business without the tax relief.

The problem . . . The ultimatum to halt salt-water pollution was delivered by the Arkansas Water Pollution Control Commission (OGJ, Aug. 25, 1958, p. 48).

The commission later approved a 5-year plan proposed by a group of the producers. Essentially, the plan calls for:

. . . Each operator in the state to reduce the volume of salt water being discharged into streams by at least 20% per year.

. . . The operators, individually or jointly, to submit each year to the commission a list of wells, volumes of salt water produced, and how the reduction would be accomplished.

. . . Water reduction by any of four methods—plugging back water-producing zones, abandoning wells, disposal of water in pits, or underground disposal.

An indication of the size of the problem can be seen in the situation at Smackover field north of El Dorado. The field has 1,500 stripper wells which surface more than 300,000 bbl. of salt water daily to produce about 15,000 bbl. of oil. This amounts to about 5,062 tons of salt daily.

One engineering study resulted in an estimate that underground salt-water disposal systems for the entire field would cost about $1,350 per producing well—or a total of more than $2,000,000. The estimate is based on conversion of old wells into disposal wells and injection of the salt water by gravity. That average cost would be increased considerably if several big disposal wells had to be drilled and high-pressure pumps installed to inject the salt water.

That meant a lot of small operators were going to have to dig deep into their pockets—or abandon some wells as uneconomic.

Tax relief . . . The state came to the rescue with the new law granting severance-tax relief.

The Arkansas severance tax is 4% or 12 cents a barrel on wells which produce 10 bbl. or less of oil per day, and 5% or 15 cents on wells which produce 10 bbl. or more daily.

The law applies to the cost of installation of salt-water injection systems. Producers say it does not apply to other methods of pollution control.

The tax relief will encourage more of the small operators to join forces with the big producers in the use of underground disposal systems.

A-Test Poll Under Way

THE BUREAU OF MINES is polling 71 companies and individuals in the oil and chemical industries to find out if they will cooperate in a proposed atomic test exploration in Colorado oil shale.

Marling J. Ankeny, bureau director, says the poll will help determine if the $2.5-million test blast will be carried out. He also is seeking official expressions on whether the nuclear experiments should be preceded by a small experiment with conventional explosives.

The nuclear blast was proposed at a meeting of oil and chemical representatives in Dallas in January (OGJ, Jan. 12, p. 58). Its cost would be shared equally by the federal Government and the two industries.

The test explosion is planned in the immense Piceance Creek oil shale deposits in northwestern Colorado's Garfield County.

Oil Law Is Pushed

in Nebraska. Conservation bill wins committee nod.

AN OIL CONSERVATION bill jumped a major hurdle in the Nebraska Legislature when it received committee approval and was sent to the floor for consideration.

In both the 1955 and 1957 sessions, similar bills were killed by committee action. Little opposition is expected for this bill now that it has committee support based on an interim study by the legislative council.

The bill calls for creation of a three-man oil and gas conservation commission. Authority would include well spacing and restriction of production to prevent waste.

The bill, worked over with 11 amendments, has the support of most major operators and a number of independents. British-American Oil Producing Co. was the only major to fight the bill during hearings.

BA objected to an amendment providing for ratable take by buyers, transporters, or other takers of crude. BA also opposed method of appeal from commission rulings. The amended bill calls for appeals to a district court with later recourse to the state

PIPELINE BRIEFS . . .

A peak-day record of 5,065,438,000 cu. ft. of natural gas was set recently by United Gas Pipe Line. United handles more gas than any other transmission company. Dispatching records disclosed that the record was set January 5. United last year delivered 1.3 trillion cubic feet of natural gas, which was more than 10% of the nation's production.

A 400-mile looping program has been contracted by Michigan Wisconsin Pipe Line. It includes 373 miles of 24-in. main line between Oklahoma and the Great Lakes and 21 miles of 16-in. in Wisconsin. The first and second contracts (spreads 1-6) went to R. H. Fulton & Co., Lubbock, Tex.; the third (spreads 7-9) to Panama-Williams Corp., Houston; and the fourth (spread 10) to Somerville Construction Co., Ada, Mich. The rush job, with completion planned July 1, will permit delivery of 80,000 M.c.f. daily of gas from Laverne field, Harper County, Oklahoma.

The problem of mixing coal tar-epoxy resin with a catalyst for external pipeline coating has been solved by applying centrifugal force for

supreme court. BA sought direct appeal to the high court.

Lease bill . . . Another proposal was sent to the floor which would make leasing of state school land more realistic.

The bill would permit annual lease rental of 50 cents per acre, regardless of size of the original bonus made under competitive bidding. Under current rules, the annual rental is equal to the bonus. Elmer Mahlin, secretary of the State Board of Educational Lands and Funds, says this discourages independents from bidding.

Alberta Cutback

due in March as crude-oil buyers ask for 15% less.

ALBERTA'S crude-oil production, which topped 400,000 bbl. daily during the first 2 months of the year, will drop approximately 15% in March.

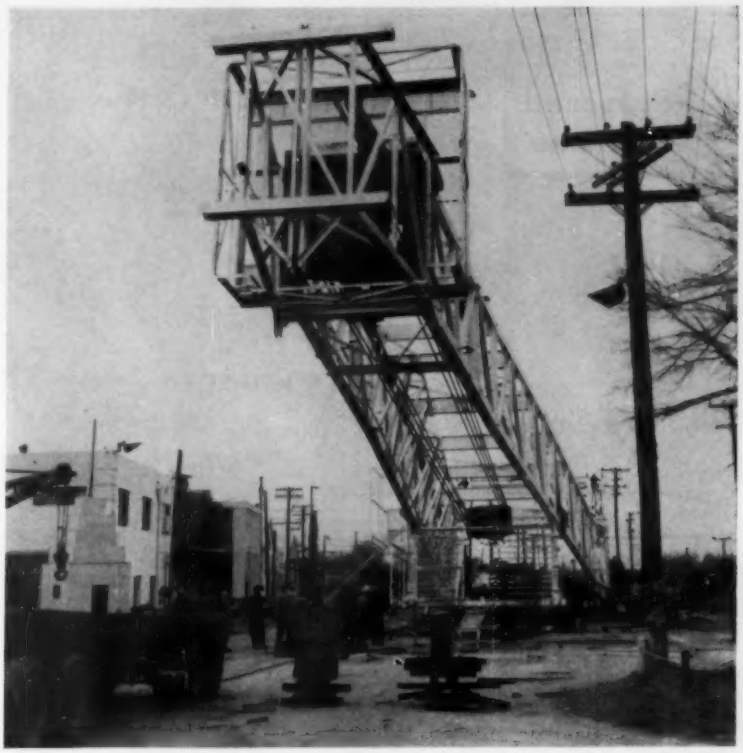
Nominations to the Alberta Oil and Gas Conservation Board total only 351,869 bbl. daily for March, compared with 413,660 in February and 403,715 in January.

An anticipated drop in demand for heating oils is blamed for most of the decrease.

Imperial Oil trimmed its purchases by 23,300 to 109,200, while British American cut its requirement by 13,855 to 56,415.

The five U. S. refiners nominating for Alberta crude seek a combined total of 38,300 bbl. daily.

General Petroleum Corp., Ferndale, Wash., will take 23,900; International Refining, Inc., Wrenshall, Minn., 8,100; Bay Refining Corp., Bay City, Mich., 4,000; Lake Superior Refining Co., Superior, Wis., 2,000; and West Branch Refiners, 300.



IPE Preparations Picking Up Speed

EXHIBITORS have started moving display equipment into the International Petroleum Exposition grounds in Tulsa with 2½ months to go before the start of the big show.

It is the vanguard of more than a half-billion dollars worth of new equipment and exhibits to be shown during the exposition May 14-23.

Among the first to start setting up exhibits was National Supply Co., which usually has one of the most extensive attractions on the grounds. National has more than doubled the area it had at the last show in 1953. The exhibit includes National's 1625-DE rig with a 142-ft. Lee C. Moore drilling mast (photo), two other rigs, 11 pumping units, wellhead displays, plunger-type pumps, and slush pumps.

IPE officials say construction on the grounds is ahead of schedule of previous show years, in spite of recent severe weather. Exhibit space is at a premium, with "99.9%" of outside and indoor space already sold.

"mixing in motion." A pilot machine designed by J. M. (Sam) Lewis for Ainslie Perrault, president, Allied Paint Manufacturing Co., was demonstrated last week for pipeline engineers in Tulsa.

A 40-mile, 20-in. line in Matagorda and Jackson counties, Texas, will be laid by Oklahoma Contracting Co. under contract for Coastal Transmission Corp. The project was scheduled to start this week.

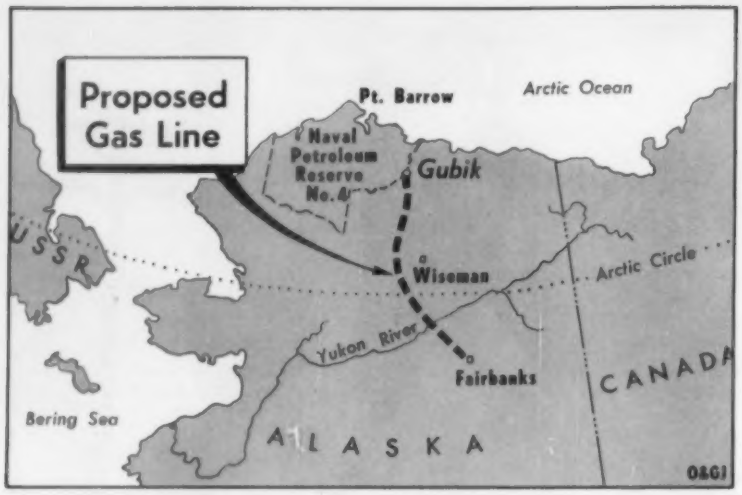
Contract to lay 41 miles of 30-in. for United Gas Pipe Line in Mississippi and Alabama has been awarded to Houston Contracting Co. The project is in two segments, 12 miles between Kiln and Gulfport, Miss., and 29 miles between Gulfport and Whistler Junction, Ala.

A crude delivery record of 852,100 bbl. per day was set last month by Service Pipe Line. This average figure for the month was 71,000 bbl. daily above December and 70,900 bbl. daily above January 1958. Service has completed the last of five new pump stations in Missouri and Illinois. The new stations have boosted capacity 64,000 bbl. daily between Freeman and La Plata, Mo., and 39,000 bbl. daily from La Plata to Manhattan, Ill.

Also for Pipeliners . . .

IN THE NEWS: Growing natural-gas market in California is attracting other suppliers to give competition to El Paso Natural for the business (p. 68) . . . The much-talked natural-gas pipeline from Gubik to Fairbanks is a step nearer for Alaskans (p. 74) . . . Texas Eastern approves a new approach to buying gas—it will buy some Louisiana leaseholds (p. 81).

PLUS THESE TECHNICAL REPORTS: Water-test nomograph tells source pressures (p. 139) . . . Oil-soluble inhibitors may solve corrosion problems (p. 139) . . . Some pipeline safety fundamentals (p. 141).



Alaskan Gas Line Closer

. . . with 2-mile buffer-zone leasing predicted. Adequate gas reserves then would cinch Gubik-to-Fairbanks line.

EXTENSIVE EXPANSION of Alaskan operations is planned by Colorado Oil & Gas Corp., Denver.

The program may include a 402-mile natural-gas line from the Gubik field to Fairbanks, costing more than $42 million.

This project depends on Interior department leasing of a 2-mile-wide buffer zone in north central Alaska separating Naval Petroleum Reserve No. 4 from recently released land to the east, owned principally by COG. The zone was established to safeguard the draining away of any petroleum discovered in the reserve (OGJ, Nov. 25, 1957, p. 62).

Leasing of the buffer zone is considered imminent. Sen. E. L. Bartlett (D-Alas.) said last week that an announcement opening the zone was expected within days.

COG has already acquired substantial lease holdings on the Gubik gas structure and two drilling rigs in the area from Alaska Propane Co. W. C. Norman, COG president, declined to disclose the extent of the company's Gubik lease holdings or prices paid for the rigs and Alaska Propane leases.

Norman said the pipeline project will be definitely scheduled if the Interior department opens up the buffer zone and COG exploration indicates adequate gas reserves.

The Navy already has agreed to lease the zone to COG and to rent the firm tractor-sled trains to haul prospecting equipment from Barrow to the Gubik field. The pipeline would be completed by the fall of 1961.

Another step . . . There's one other important requirement to early drilling to determine the extent of the reserves, Norman said.

That's a firm commitment from the Defense Department to use natural gas for its larger fuel requirements at Eielson and Ladd Air Force Bases and other military installations in the Fairbanks area.

Norman said the availability of natural gas at Fairbanks would cut the high cost of living there by reducing fuel and heating costs by about 50%. It also would encourage industry.

PROCESSING BRIEFS . . .

Tetraethyl-lead prices were cut 0.51 cent per pound by Du Pont and Ethyl Corp. effective February 25. Based on equivalent tetraethyl lead content, Du Pont's new price for motor mix is 60.24 cents per pound; for motor mix A, 61.24 cents; and for aviation mix, 66.14. Ethyl's new prices for motor mix, motor plus, and aviation mix are comparable. Last price change was early in December when prices went up 0.6 cent per pound.

Regular gasoline quality inched up to 91.6 research octane in February, one-tenth of an octane above January's nation-wide average. Ethyl Corp.'s monthly survey showed the February premium count at 99, unchanged from the previous month. Both grades are up half an octane over the same month last year.

A 6,600-bbl. HF alkylation unit will be constructed at Phillips Petroleum's Kansas City refinery. Phillips awarded a contract to build the unit to Procon, Inc. Construction is slated to be completed late this year.

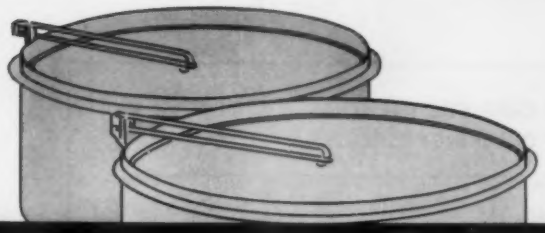
New facilities for manufacturing lithium-base greases has been completed by Texaco Canada at its Toronto plant. The facilities, built mainly around the Stratco contactor process, will increase plant capacity for all greases by 50%.

Union Pacific Railroad is buying 75 turbocharged diesel electric locomotives from General Motors for more than $19 million. The 2,400-hp. locomotives will be built to burn low-grade fuel instead of more expensive diesel fuel now being used. Thirty are to be delivered in July, the remainder next fall.

Also for Refiners . . .

IN THE NEWS: Refiners' gross return from a barrel of products has risen steadily from last spring's low point. Cost of crude has dropped to brighten the refining income picture (p. 59) . . . Price adjustments downward continue for crudes in Texas, Oklahoma, and Kansas (p. 60) . . . Texas governor threatens probe of price cutters and oil importers (p. 61) . . . Esso offers to build atomic tanker with federal aid (p. 63) . . . Imports of crude and unfinished products both show sharp drop in January (p. 70).

PLUS THESE TECHNICAL REPORTS: Petroleum Chemical, Inc.'s plant expansion (pp. 49-106). . . . WPRA Refining Quiz—Part 2 (p. 127).



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- Interleafed galvanized weather shield protects sealing band from reflected sunlight, rain, snow, etc.

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P80CB

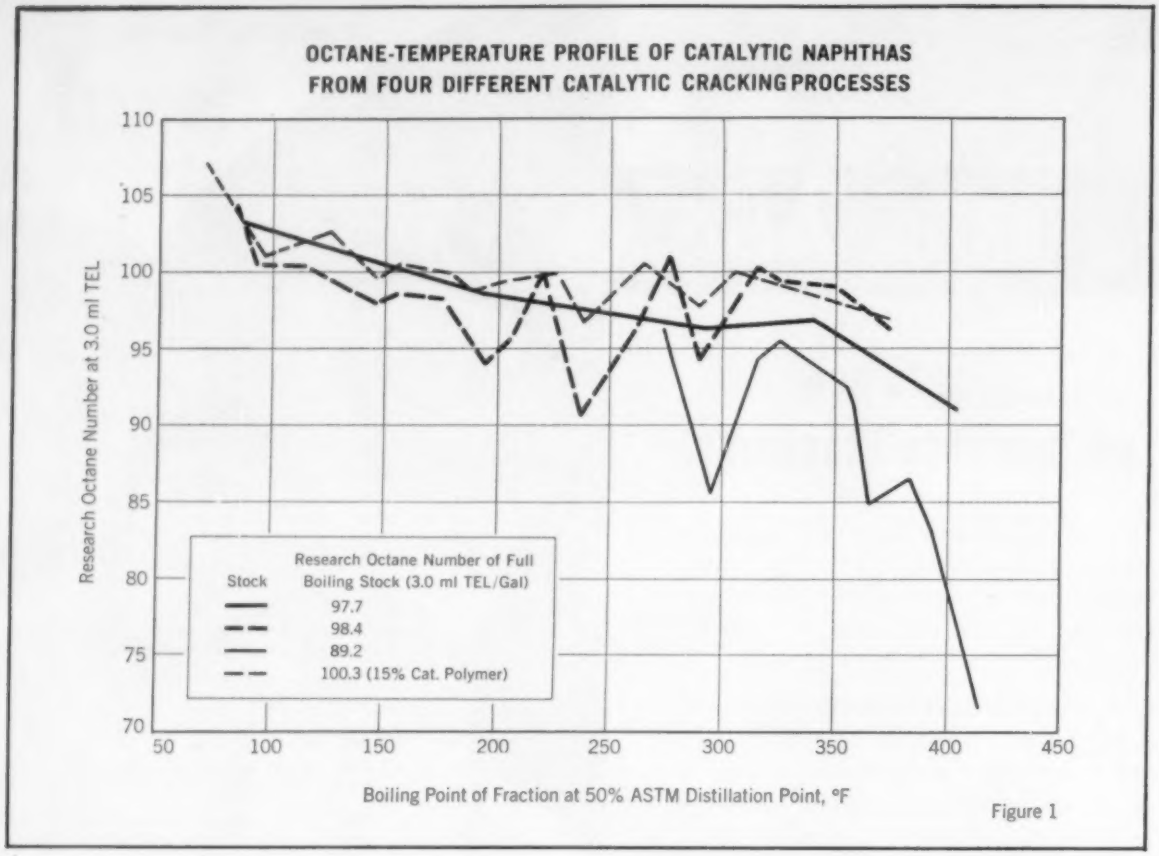


Figure 1

Octane profiles show how to use high-octane gasoline components more effectively

By D. D. Hornbeck, Refinery Technologist

IN RECENT YEARS, refiners have shown interest in separating high (and low) octane hydrocarbons of gasoline blend stocks. Fractional analysis has been used to separate, for distribution studies, such stocks as cracked gasoline, reformed gasoline, reformer charge stock and, in some cases, finished gasoline.

A report of several "octane profile" studies conducted in Ethyl's Detroit Laboratories is now available.

How "Octane Profiles" Are Drawn

A sample is carefully fractionated into narrow cuts of 5 to 10 percent of the total fuel. Laboratory octanes, and other pertinent data such as hydrocarbon type are obtained on each fraction. A plot of the distribution of antiknock quality throughout the boiling range of the gasoline is then drawn. This plot is referred to as an "octane profile."

Fractional Analysis For Octane Improvement Studies

In a refinery where tetraethyllead is near the allowable maximum, splitting an existing process stream and blending the higher octane fraction to a given gasoline grade may be an effective approach to octane improvement.

This technique doesn't increase the antiknock quality of the gasoline pool. But frequently it permits the refiner to meet higher octane specifications for a given grade of gasoline.

And higher octanes generally are possible with lower investment and operating costs than by other process methods.

The "octane profiles" of four catalytically cracked gasolines from different refining processes are compared in Figure 1. It will be noted that distribution of high and low-octane hydrocarbons throughout the boiling range of the stock follows a general pattern.

Each stream can be split to yield a portion that is higher in antiknock quality than the full-boiling material. This is true of almost all cracked gasolines even though large differences in octane quality exist at various points in the boiling range.

With the cracked gasolines shown, 30 to 50 percent of the light fraction is from 2 to 4 Research octane numbers higher than the full-boiling material.

Figure 2 compares "octane profiles" of four gasolines from different catalytic reforming processes. In this case the heavy fractions will yield a 20 to 40 percent cut that is 2 to 6 RON higher than the full-boiling material.

Fractional Analysis For Examination of Charge Stock

Figure 3 shows "octane profiles" of two

catalytic-reformer charge stocks. The straight run naphtha contains a front-end cut that is already satisfactory blending stock for regular gasoline. Further, the hydrocarbon-type composition showed no naphthenes in this fraction and, therefore, its value as part of reformer feed is questionable.

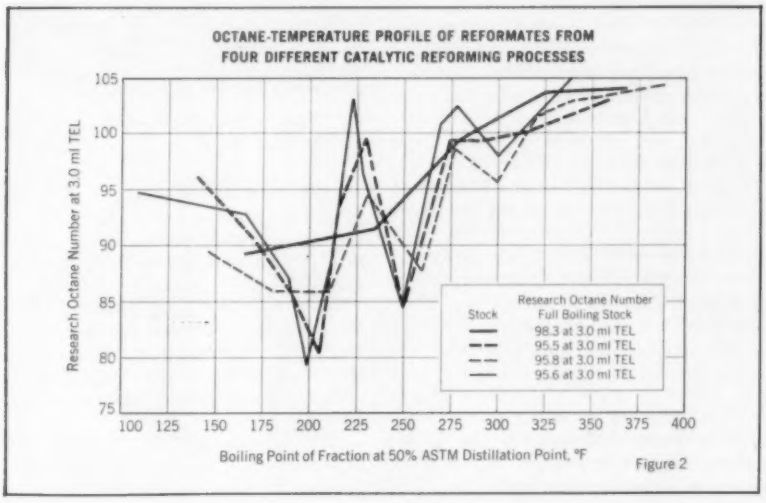
Similarly, the pressure distillate shown in the same figure contains high-octane light olefins according to hydrocarbon-type analysis and "octane profile." This cut could very well be blended directly to motor fuel since, as part of the reformer charge stock, the high-octane olefins would be saturated.

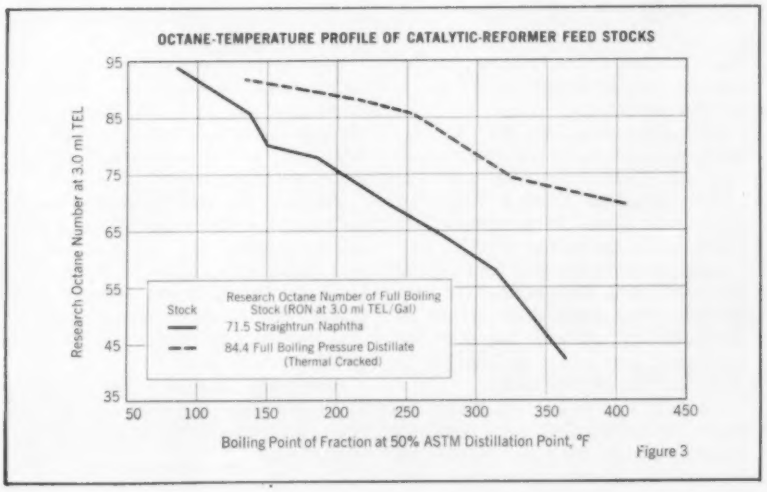
Finding the Cause of Knocking Problems

"Octane profiles" help in understanding some low-speed knocking problems. In engines where the vapor and liquid portions of a fuel are unevenly distributed to the cylinders, TEL may tend to concentrate in the heavier fraction.

Maldistribution usually is most pronounced in the first seconds of wide open throttle accelerations. The problem is aggravated with fuels of low tetraethyllead levels since lighter components may be practically free of antiknock agent upon entering a cylinder during the first moments of acceleration.

With fuels having low-octane front-end components, low-speed road-knock may occur since the front-end octane level may be 5 to 10 numbers below the octane of the whole fuel. The portion of the fuel causing this difficulty can be isolated by fractional analysis. These problems may be solved by replacing the low-boiling, low-octane fraction with higher quality material.


OCTANE-TEMPERATURE PROFILE OF REFORMATES FROM FOUR DIFFERENT CATALYTIC REFORMING PROCESSES
Research Octane Number at 3.0 ml TEL
105
100
95
90
85
80
75
100 125 150 175 200 225 250 275 300 325 350 375 400
Boiling Point of Fraction at 50% ASTM Distillation Point, °F
Stock
Research Octane Number Full Boiling Stock
98.3 at 3.0 ml TEL
95.5 at 3.0 ml TEL
95.8 at 3.0 ml TEL
95.6 at 3.0 ml TEL
Figure 2


OCTANE-TEMPERATURE PROFILE OF CATALYTIC-REFORMER FEED STOCKS
Research Octane Number at 3.0 ml TEL
95
85
75
65
55
45
35
50 100 150 200 250 300 350 400 450
Boiling Point of Fraction at 50% ASTM Distillation Point, °F
Stock
Research Octane Number of Full Boiling Stock (RON at 3.0 ml TEL/Gal)
71.5 Straightrun Naphtha
84.4 Full Boiling Pressure Distillate (Thermal Cracked)
Figure 3

How Ethyl Research is helping you

Ethyl Research is continually utilizing its extensive laboratory fractionating facilities to help refiners in these ways:

1. To develop quality distribution data for octane improvement studies.
2. To evaluate charge stocks.
3. To understand unusual fuel knock problems.

Results of several of these studies can be found in Ethyl's report, "Fractional Analysis of Some Refinery Process Streams."

Copies of the report are available from your Ethyl Representative, or by writing to Ethyl Corporation, 100 Park Avenue, New York 17, New York.

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the JOURNAL *said.....*

50 *years ago*

March 6, 1909

Sale of 100,000 bbl. of Glenn Pool crude at 30 cents a barrel to Southern Pacific railway, is announced. W. H. Millikin, who made the sale, said the oil has been in tanks at Mounds, Okla., 2 years.

A strong stand against removal of the duty on imported oil is made by Mid-Continent Oil and Gas Producers Association. A resolution, addressed to members of Congress, warns of excess Mexican oil, and increasing imports from Asia.

Pipeline construction is starting at four points in Texas, Oklahoma, and Louisiana by The Texas Co. A loop between Stuart and Armstrong, Okla., and a loop between Sherman and Dallas, Tex., will be 8-in. lines. A 6-in. line will be built from Caddo, La., field to Shreveport. The fourth line will be from Nederland to Texas' Port Arthur refinery.

25 *years ago*

March 1, 1934.

The U. S. Government may use its war powers to control oil operations because private operation has been highly wasteful and state regulation has not adequately coped with conservation, the AIME is told by Nathan R. Margold, Interior Department solicitor.

The oil and coal industries, overwhelmed with confusion, have come to Washington, on their knees begging for help, Interior Secretary Ickes tells Cook County League of Women Voters in Chicago. The oil industry, he said, has been a perfect example of unchecked and ruthless exploitation. He said it is the most arrogant and haughty industry in the U. S. and has been "a law unto itself."

10 *years ago*

March 3, 1949.

Oil imports are designed to supplement and not supplant domestic supply, G. V. Holton, board chairman of Socony-Vacuum; H. T. Klein, Texaco president, and Eugene Holman, Jersey Standard president, state in individual letters to governors of Texas and Oklahoma.

Brazil's first petroleum pipeline, extending 30 miles from the sea coast inland to Sao Paula industrial area, will deliver 45,000 bbl. of products daily. Williams Bros. Co. of Tulsa is doing the engineering.

Possibilities of a loan up to $500,000,000 for expansion of Mexico's oil industry are being explored in Washington by Antonio Bermudez, manager of Pemex.

Dollarhide Unit Sought

. . . by operators in West Texas field. Water flooding of three pays, pressure maintenance in two others planned.

UNITIZATION and secondary recovery are just around the corner for most of big Dollarhide multipay field in West Texas.

An even dozen Dollarhide operators, headed by Pure Oil Co., last week asked the Texas Railroad Commission to authorize a unit and approve secondary recovery or pressure-maintenance operations for all of the field's five reservoirs.

Pure, as projected unit operator, outlined plans for early water flooding of Dollarhide's Clearfork "AB" and "C" zones and the Devonian pay and pressure maintenance in the Silurian and Ellenburger pools.

The Devonian and Clearfork programs, the company said, will cost between $1,900,000 and $2,250,000 and recover between 12,500,000 and 23,000,000 bbl. above primary take.

For the present, Pure says, it plans to conduct pressure maintenance and control water production in the Silurian and Ellenburger pays by transferring well allowables, with a view to employing injection later if needed.

Pure estimates oil originally in place in the five pays under the proposed unit area at 417,720,000 bbl. The company broke this figure down as: 44,700,000 for the Clearfork "AB," 4,000,000 for the Clearfork "C," 104,650,000 for the Devonian, 185,000,000 for the Silurian, and 80,000,000 for the Ellenburger.

The unit would take in 63 wells on 2,500 acres of the Clearfork "AB," 13 wells on 520 acres in the Clearfork "C," 107 wells on 4,740 acres in the Devonian, 56 wells on 2,587 acres of the Silurian, and 44 wells on 2,227 acres of the Ellenburger.

The Clearfork . . . Primary production in the Clearfork reservoirs is nearing depletion.

Both the "AB" and the "C" are solution-gas pools. Pressures are dropping and GOR's climbing fast. The "AB," topped at 6,500 ft., was discovered in June 1949; the "C" at 7,300 ft. in December 1953.

Original pressure of 2,980 psi. in the "AB" now has declined to only 703 psi. Pure intends initially to inject water through only two wells but eventually will adopt a five-spot or modified five-spot pattern.

Cost of the flood will range between $600,000 and $700,000. Oil recovery should be hiked 40 to 60% over primary, or from 3,576,000 to 5,184,000 bbl.

Water input into the "C" zone, by far the smallest and poorest pay in the field, is expected to hike oil recovery by about 30 to 40% or by about 247,500 to 330,000 bbl.

The Devonian . . . The Devonian, discovered in August 1945 at 8,000 ft., also is a solution-gas type reservoir. It is the largest pay in the field from the standpoint of acreage (4,740), though ranking second to the Silurian as to oil in place.

Here, too, pressure is dropping and GOR's climbing.

Plans call for injecting water through four wells to start and later probably using a peripheral pattern.

Pure estimates primary recovery from this zone at 17,500,000 bbl. It thinks the flood will recover an added 50 to 100% of this volume—or 8,750,000 to 17,500,000 bbl. Cost of the flood would range from $1,200,000 to $1,400,000.

Silurian and Ellenburger . . . Both of these pays produce with water drives. But water production in both now is reaching substantial proportions.

Pure asks that the projected unit be permitted to transfer allowables of the heavy water producers. It could thereby slow the pressure drop in these zones by sharply reducing total water output.

The Silurian at 8,500 ft. and the Ellenburger at 10,000 ft. were discovered at Dollarhide in 1947.

Pure doesn't estimate how much oil such pressure maintenance might add to primary recovery.

Participation in the two Clearfork zones would be based on allowables as assigned by well tests during primary production, changing to 50% on well and 50% on acreage during secondary operations.

Formula for the Devonian would be based on allowables and tests also during primary, on net acre-feet of pay during secondary.

Those for both the Silurian and Ellenburger would be based on gross acre-feet of pay above the oil-water contacts.

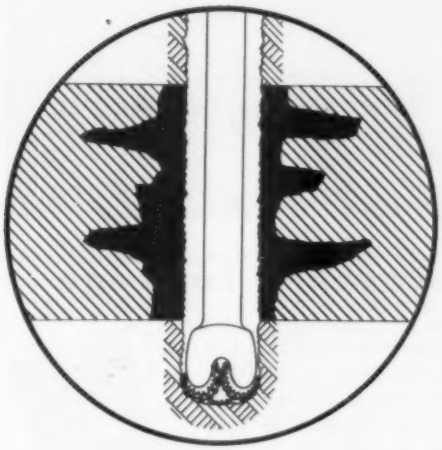
The projected units would adjoin a flood project proposed earlier this year by Cities Service for its acreage in the field.

HALLIBURTON HYDRO-LOK

THE ANSWERS TO BETTER WATER CONTROL

A major problem in air and gas drilled wells is the control of in-flow water. Halliburton HYDRO-LOK . . . a group of three effective water control agents has been specifically developed to help solve this troublesome problem.

HYDRO-LOK (PC-11) consists of a thermosetting resin and inert solids. It forms an insoluble plug having high compressive strength, resulting in an effective seal . . . May be placed like cement slurry, either dumped with bailer or pumped opposite the formation by the two-plug method. When the squeeze pressure is applied, the resin enters the formation where setting is accelerated on contact with interstitial water . . . Adaptable for zones of high permeability, fractured sandstones and limestones. Because of the low viscosity of the resin phase in the slurry, relatively long sections of water producing horizons with varying permeability may be treated.



HYDRO-LOK (HG-10), the resin used in PC-11, contains no inert solids; therefore, its primary application is for conditions where maximum resin penetration is required.

HYDRO-LOK (PWG) is a low viscosity fluid that sets to form a stiff gel. The low viscosity is maintained for 95% of its pumping time, aiding entry into the true permeability of the water bearing formation. When PWG enters its setting phase, an extremely stiff gel results in less than an hour, thus minimizing costly rig downtime. Other advantages of HYDRO-LOK (PWG) include:

- **Holding back relatively high formation pressure.**
- **Adjustable to well temperatures from 32° to 200°F.**
- **Nature of set minimizes danger of sticking tools.**
- **Is insoluble in water, acid or oil.**
- **Still sets satisfactorily when diluted as much as 50% by formation water.**
- **Also useful in grouting operations and in mine shafts.**

The Halliburton HYDRO-LOK group of materials has demonstrated water control effectiveness in many field applications. For better water control in air or gas drilled wells *and* grouting operations, specify Halliburton HYDRO-LOK.

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How gasoline plant solves a serious valve problem

Crane Valve Puts Fast Stop on Gasoline Leakage

Shortly after installation, the cock in a raw gasoline line at this large Southwestern gasoline plant began to stick and leak. Corrective maintenance failed to end the trouble.

So, for positive shutoff, the cock was replaced. But, this time, with a Crane No. 3602X 2-inch, 600-pound steel wedge gate valve. Now in operation more than nine months on the 100 psi gasoline line, it never sticks or leaks, and has needed no maintenance, not even frequent periodic lubrication.

Crane No. 3602X steel wedge gate valves are favorites in the oil and gas industries for installations on lines handling oil and oil vapors. They have Exelloy seats, disc and stem giving them extra-long-wearing surfaces to keep maintenance costs down. Compact yet rugged, these valves are well suited for many refinery and field applications.

If you have valve problems, you can depend on your Crane Representative for accurate, practical advice. Don't hesitate to ask for his help next time he calls. Or, write to address below for recommendations.

Ask for Crane folder AD-1881, which covers the Crane line of 600-pound small steel gate valves—with union bonnet or bolted bonnet.

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New Purchase Plan

adopted by Texas Eastern in move to get Louisiana gas.

A PIPELINE company's plans for a multimillion-dollar purchase of leasehold interests in a big Louisiana gas field will be heard by a Federal Power Commission examiner March 10.

Texas Eastern Transmission Corp. proposes to purchase leasehold interests in Rayne field through a newly formed subsidiary for $181,065,000. About 1 trillion cubic feet of gas is involved.

The purchase, marking a new departure in gas acquisition by a transmission company, would be effected through the new Louisiana Gas Corp.

Under the revised plan, Texas Eastern would acquire the producing properties in the Acadia Parish field from four independent producers. They are Continental Oil Co., Sun Oil Co., General Crude Oil Co., and M. H. Marr, of Dallas.

Earlier, Texas Eastern had been seeking FPC authority to purchase about 110,000 M.c.f. of gas daily from the South Louisiana field. The company also proposed a $48,632,000 expansion of its pipeline system to handle the new gas supply.

An FPC presiding examiner handed down a favorable decision last April. He approved both the construction program and the sale of gas by the producers. Since then, exceptions have been filed by several parties, and the FPC has withheld final approval of the project.

The FPC reopened the case last week to hear Texas Eastern's alternate proposal.

Gas Sale Required by FPC

THE FEDERAL Power Commission has revoked its recent order permitting Panhandle Eastern Pipe Line Co. to abandon gas service to Detroit and Ann Arbor, Mich.

Under the new ruling, Panhandle must continue gas sales to the rival Michigan Consolidated Gas Co. until the FPC can determine "proper" allocation of the gas involved.

Hearings on the allocation are scheduled to begin June 16 in Washington. Under the earlier order, sales involving 127,000,000 cu. ft. of gas per day would have halted March 15.

Panhandle's contract with Michigan Consolidated had a 1951 expiration date, and Panhandle has tried repeatedly to get FPC approval to discontinue service (OGJ, Dec. 29, 1958, p. 76). In its December 19 order, now stayed, the commission ruled in effect that other Panhandle customers needed the gas more than Michigan Consolidated did.

Since then, the commission has turned down Panhandle's proposal to increase its gas deliveries to communities in Michigan, Indiana, and Ohio.

Pure Appeals Rule

of FTC that would require general price cuts or none.

PURE OIL Co. has filed notice of appeal from a ruling by a Federal Trade Commission examiner which would prohibit the company from localizing gasoline price wars.

If allowed to stand, the sweeping order would forbid the company to reduce gasoline prices in one of its competitive markets unless proportionate price cuts were made elsewhere in its marketing area.

The decision, by Examiner Robert L. Piper, is subject to review by the full commission.

Pure's dealer discounts during a 1956 price war in the Birmingham area were held to be discriminatory and in violation of the antitrust law.

The company adopted a "one-cent plan" to permit its dealers to price their gasoline within 1 cent of the average posted price for private brands. Participating dealers were allowed temporary discounts to maintain a profit margin of 4 cents per gallon. The same discount was available to dealers who chose not to cooperate in the 1-cent plan.

The order would dismiss other charges, that Pure had discriminated in price among its own competing customers and had conspired to fix retail prices.

INDUSTRY BRIEFS . . .

Louisiana's allowable for March virtually is unchanged from February levels. An increase of less than 5,000 bbl. daily is permitted for new wells, running total production to an estimated 868,000 bbl. daily.

Construction of world's largest tanker is step nearer. U. S. Maritime Administration has agreed to insure the mortgage on the 106,500-ton tanker which Stavros Niarchos' Transoceanic Marine, Inc., plans to build at the Bethlehem shipyard in Quincy, Mass. The ship would cost $26 million and would be slightly larger than the 104,500-ton Universe Apollo recently launched in Kure, Japan, by D. K. Ludwig.

Trial of a suit filed by Atlantic Refining Co., Tidewater Oil Co., and others to upset the proration formula in Texas' Normanna gas field has been postponed a second time to March 3.

The suit attacks the practice of the Texas Railroad Commission in preparing allowables for gas fields where there are small tracts on a basis of two-thirds acreage, one-third well. Atlantic seeks a smaller well factor in the formula to prevent a small-tract well drilled by Bright & Schiff, Dallas independent, from draining gas from its adjoining leases.

The first offering of Navajo lands in Arizona for oil and gas leases has been scheduled by the Navajo Agency. Bids on 20 tracts totaling 2,400 acres are being accepted by the agency at Window Rock, Ariz., until March 31. The tracts, ranging from 40 to 160 acres, are in Apache County.

Underground storage will be developed by Pacific Gas & Electric in Pleasant Creek gas field 50 miles northeast of San Francisco. PG&E plans to spend more than $2,500,000 to give the partially depleted field working storage of 3,250,000 M.c.f. and maximum withdrawal rate of 80,000 M.c.f. daily. Compressors will be installed in April if the state utilities commission approves the request. PG&E also plans to store gas in McDonald Island field 50 miles east of San Francisco.

A new plan has been filed with the Security and Exchange Commission by Cities Service for elimination of the minority interest in Arkansas Fuel Oil Corp. The SEC has ordered Cities Service to either eliminate the public minority interest in Arkansas Fuel or to dispose of its own majority interest. The new proposal calls for an exchange of one share of Cities Service stock for 2.4 shares of Arkansas Fuel stock.

Landa Oil Co. of Dallas has acquired Souris Valley Oil Co. of Winnipeg, Manitoba, in exchange for 161,518 shares of Landa common stock. Souris Valley has producing properties in Manitoba, Saskatchewan, and Alberta, and about 50,000 net acres of nonproducing leases.

Shell Develops New Well Test System

A NEW automatic well test system is operating in Louisiana's Bayou Sorrel field. Shell Oil Co. engineers in New Orleans developed the system to test individually and record the production performance for 35 wells.

A tape-punching device makes a multiple series of holes in a strip of paper to record information from the tests. A tape reader then "reads" the tape and translates the data into figures on a panel which may be read and recorded visually.

Shell is installing three more testing units in South Pass Block 24 field and another in White Castle field.

Texas Tax Fight Is Fanned

. . . by legislator's proposal of stiffer tax on dedicated gas reserves. It would bring in about $90,000,000 a year.

OPPOSITION of the Texas petroleum industry to a tax on gas reserves dedicated under long-term contract appears to have had an undesirable effect on some Texas legislators.

Rather than squelch the bill, it may have fanned some legislative flames.

Many in the industry, including the Texas Mid-Continent Oil and Gas Association, strongly criticized Gov. Price Daniel's bill to levy a 3% of value tax on dedicated reserves. Critics argued that petroleum in Texas is already bearing far too much of the state tax burden and the state soon might find itself beating a dead horse.

The Daniel bill was introduced by Rep. George T. Hinson of Minola.

Last week Hinson said he will introduce another bill to tax dedicated reserves of gas—one which would levy a much stiffer tax, a flat rate of 2 cents a M.c.f.

The governor estimated the Daniel bill would raise about $20,000,000 a year. The threatened new Hinson bill would bring in 4½ times as much, $90,000,000 a year.

Hinson said he wasn't abandoning the Daniel bill but was offering an alternative.

"I will push this one only if there is enough interest in it. But it provides a means of raising the money we need for the next 2 years without going to a general sales tax or a bunch of selective sales taxes."

Hinson said 62% of his tax would be paid by out-of-state consumers and that it would hike the average residential gas user's monthly bill by less than 25 cents.

The Texas legislator pooh-poohed a contention that such a tax would discourage industry from coming to Texas. He called this a "bunch of hooey."

He said he would expect the gas industry to contest the bill in court if it became law.

"But this bill is no more subject to a court case than any other tax, including general sales tax."

Purchaser bill in hopper . . Further legislation to correct what Gov. Daniel's import study commission termed "anticompetitive practices encouraged by excessive oil imports" was introduced in the Texas senate.

The bill, introduced by Sen. Grady Hazlewood, Amarillo, would revise the Texas common-purchaser act to reduce discriminatory buying and nonratable taking of oil. It would:

. . . **Prohibit a purchaser** from setting up a "buffer" firm so that its own crude production could be favored.

. . . **Require a common** purchaser to buy ratably over its entire pipeline system to forestall selective buying from one field at the expense of another served by the same carrier.

Require common-carrier pipelines to make "reasonable" extensions of its gathering systems to wells in the vicinity—with the Railroad Commission to determine what connections are reasonable.

. . . **Prohibit a common** purchaser from changing ownership or control of its well connections or pipelines without approval of the commission.

. . . **Subject to such** regulation all independent gathering systems and trucking firms which buy crude for resale. These formerly have not been classified as common purchasers in many cases.

Tidelands Case Reset

ARGUMENT in the tidelands boundary case has been reset by the Supreme Court for next October 12.

The court had delayed the hearing indefinitely last fall, presumably because of the resignation of Justice Harold H. Burton.

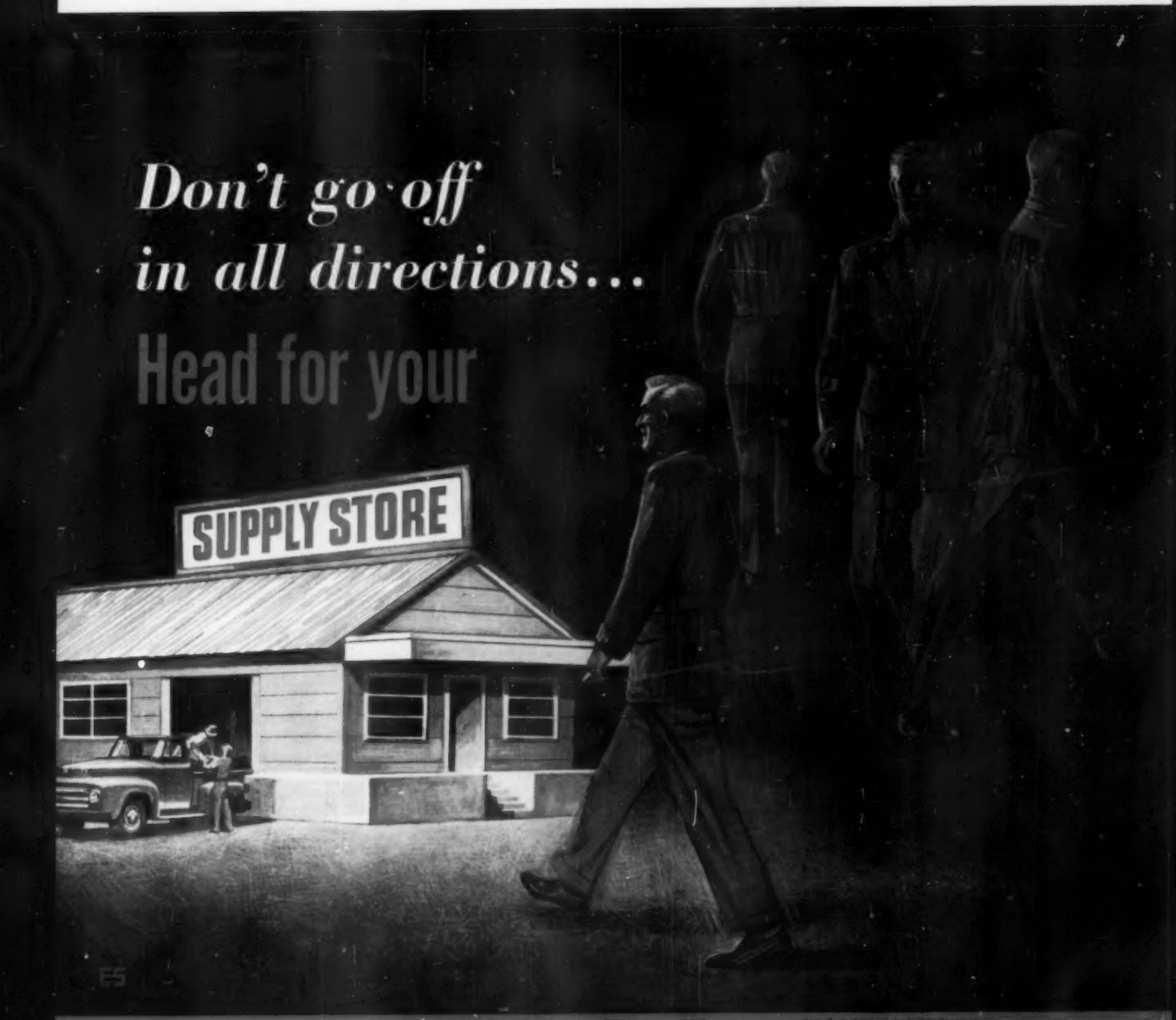
At stake in the case are many millions of dollars in revenue from oil reserves in the Gulf of Mexico. The federal Government is seeking to set the seaward boundary of the five Gulf Coast states at 3 miles from shore. The states are claiming jurisdiction at least to the 10-mile line.

Shell Hits in Mississippi

SHELL Oil Co. is adding a new producing county in Mississippi at an oil discovery 25 miles east of Jackson in Scott County.

The 1 Rogers Estate et al., in Section 9-5n-6e, flowed at an estimated 165 bbl. of oil daily through ¼-in. choke while testing an Upper Cretaceous-Eutaw sand at 6,410-20 ft. Gravity is 27° to 32°. The hole was carried to 11,062 ft.

Nearest production is 15 miles away at Boykin Church, Smith County, which borders Scott County on the south. Nearest Eutaw sand production is more than 35 miles northwest of the new discovery in Pickens field.



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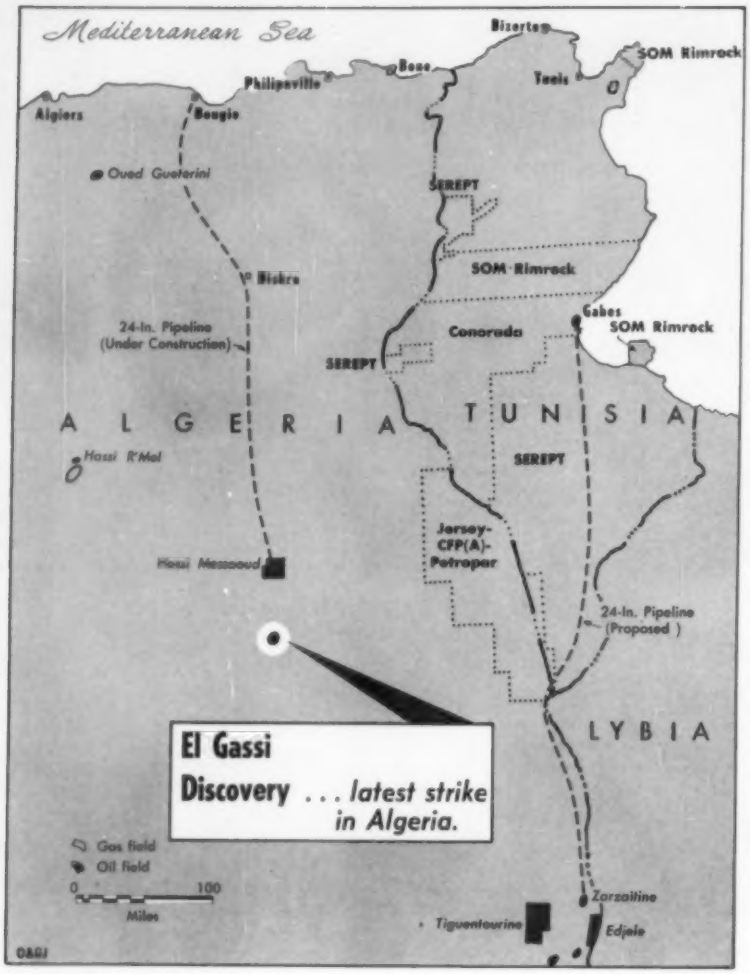


Sahara Wildcat Hits

. . . in same zone as famed Hassi Messaoud field, flowing at 2,250-bbl. daily rate. French company is operator.

ALGERIA'S central Sahara region, already famed for its massive Hassi Messaoud field, can now claim a new and promising Cambro-Ordovician discovery more than 60 miles south of the area's biggest oil field.

Ste. Nationale des Petroles d'Acquitaine has a field discovery at El Gassi which could become a smaller Hassi Messaoud.

After a month of testing, SNPA revealed last week the well flows at the rate of 2,250 bbl. daily on production tests of a 243-ft. pay section found below 10,400 ft. Bottom-hole pressure is 6,330 psi.

The crude is comparable, the company says, to the 44°-gravity oil being produced at the big Hassi Messaoud field to the north.

SNPA, the company which is developing metropolitan France's huge Lacq gas field, controls 51% of a four-company French combine which drilled the well. Cie. de Participations de Recherches et d'Exploitations Petrolieres (Coparex) has 25% interest in the operation; Ste. Franco-Africaine de Recherches Petrolieres has 14%; and Ste. de Recherches et d'Exploitation de Petrole (Eurofrep) has the remaining 10%.

The four-company combine got the 2,398 sq. km. concession (about 925 sq. miles) just a year ago after SN Repal had to surrender a portion of its Oued Myra concession on which a part of Hassi Messaoud is located.

The large crescent-shaped anticline on which the first test was drilled lies only partially in the SNPA acreage. Its flanks are in the southern portion of the Oued Myra acreage retained by SN Repal. The anticline itself was located by Repal's geophysical work.

Pay zone higher . . . Significance of the new well is that it found a productive horizon at 10,500 ft. in the same sandstone-quartzite which produces 500 ft. deeper at Hassi Messaoud.

Last week the operator had landed 7-in. casing at the top of the Ordovician at 10,400 ft. and deepened the hole.

Hassi Messaoud progress . . . To the north, 60 to 70 miles, the SN Repal-CFP (A) partnership has now completed 24 deep producers in the Sahara's biggest field.

Last week the two companies had 14 rigs running in the field. Ten of the drilling wells were already in the pay or approaching it.

A single well, OMG 57, completed late last year 12 miles north of established production, probably has doubled the size of the field (OGJ, Dec. 22, 1958, p. 53).

This northernmost well is 25 miles from the proved southern flank of the field. Hassi Messaoud stretches for at least 20 miles on a southwest-northeast trend.

The big field has already produced well over 3½ million barrels oil with only a 6-in. pipeline outlet serving 7 wells. Production started late in December 1957.

The companies are expected to be moving 80,000 bbl. daily before the end of this year when a 24-in. crude line to the Mediterranean is completed. The addition of two more pumping stations to the line is expected to boost this to 280,000 bbl. daily.

If SNPA's latest find, in an identical geological formation far to the south, proves the big anticline to be productive, that 24-in. line may have to be extended to the south, opening up an entirely new and vast area of the central Sahara to production.

World Output Soars

. . . to new high in December as Kuwait dips, but U. S. and Venezuelan production take up the slack.

FREE-WORLD CRUDE production rose slightly in December to reach another all-time high.

The Middle East was the only area not showing a net gain. A slight decline was caused by lower production in Kuwait, where output slipped from a 1.5 million barrel daily record.

Producers in the U. S. and Venezuela both had their best month in the year. Newcomers to Venezuela made a dent in the production picture by lifting more than 105,000 bbl. daily from Lake Maracaibo. Superior Oil averaged 39,400 bbl. daily; Venezuelan Sun, 29,700 bbl. daily; San Jacinto, 19,600 bbl. daily; and Signal, 16,400 bbl. daily.

Gains were made by Creole Petroleum, at 1,167,200 bbl. daily, and Shell de Venezuela, at 819,400 bbl. daily. But the third and fourth ranking producers were down, Mene Grande, to 389,900 bbl. daily, and Socony Mobil, to 132,700 bbl. daily. Other operators, whose output ranged from 55,800 bbl. daily down to 1,600 bbl. daily, included Sinclair, Richmond, Texaco, Mercedes, Atlantic, Phillips, and Talon.

TREND OVER LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total Free World outside U.S.
1957			
December	3,669.6	3,966.8	8,416.7
1958			
January	3,680.4	4,034.0	8,465.6
February	3,798.7	4,057.6	8,662.1
March	3,672.6	4,243.0	8,631.3
April	3,613.5	4,109.2	8,528.0
May	3,582.9	4,087.8	8,468.2
June	3,678.0	4,156.8	8,654.2
July	3,777.0	4,247.2	8,832.6
August	3,828.4	4,334.0	8,971.5
September	3,769.8	4,535.2	9,120.8
October	3,891.3	4,482.3	9,177.5
November	4,037.8	4,472.1	9,309.5
December	4,123.7	4,438.1	9,370.1

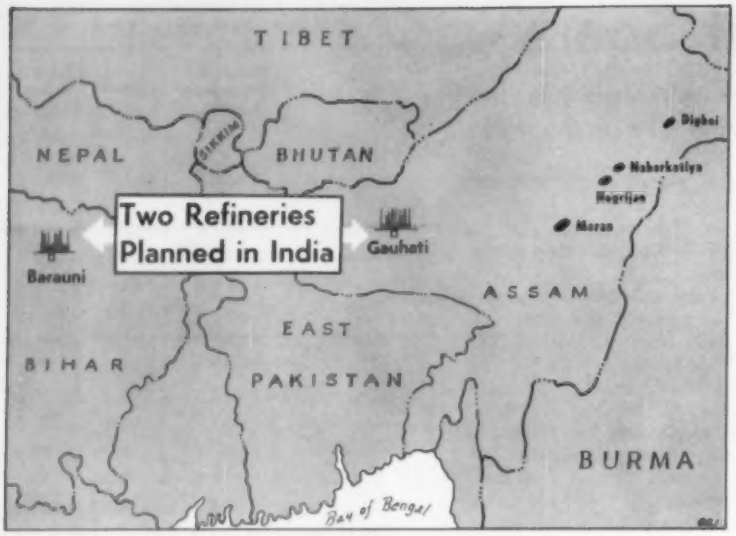
World-Wide Crude Production: Daily Average in Thousands of barrels

Country—	Dec. 1958	Nov. 1958	Dec. 1957
Western Hemisphere			
Argentina	113.4	113.4	97.0
Bolivia	9.1	9.1	9.4
Brazil	57.4	57.4	39.1
Canada	505.0	451.0	431.4
Chile	15.7	15.7	13.7
Colombia	135.0	135.2	128.7
Cuba	0.5	0.7	1.0
Ecuador	9.0	9.0	9.4
Mexico	269.0	269.0	247.7
Peru	54.3	54.3	54.0
Trinidad	106.8	106.8	96.3
Venezuela	2,848.5	2,816.2	2,541.9
Total	4,123.7	4,037.8	3,669.6
Europe			
Austria	51.2	51.2	58.1
France	28.6	27.7	27.2
West Germany	91.8	89.9	85.4
Italy	21.4	21.4	26.3
Netherlands	34.6	33.4	31.8
Turkey	6.5	6.5	5.6
United Kingdom	1.7	1.7	1.7
Yugoslavia	8.6	8.8	7.6
Total	244.4	240.6	243.7
Middle East			
Bahrain	45.2	45.3	34.3
Iran*	827.0	811.0	731.0
Iraq†	798.0	781.8	628.3
Israel	2.0	2.0	1.2
Kuwait	1,442.7	1,504.6	1,276.1
Neutral Zone	104.6	104.6	73.5
Qatar	184.0	188.6	169.1
Saudi Arabia	1,034.6	1,034.2	1,053.3
Total	4,438.1	4,472.1	3,966.8
Other Asia			
British Borneo	104.6	104.6	114.8
Burma	10.5	10.5	8.0
India	8.5	8.5	8.9
Indonesia	325.0	320.0	322.6
Japan	7.6	7.6	6.5
New Guinea	5.1	5.2	5.8
Pakistan	5.9	5.9	6.0
Total	467.2	462.3	472.6
Africa			
Algeria	13.0	13.0	0.1
Angolia	2.0	2.0	
Egypt	62.3	62.3	57.0
Gabon	11.3	11.3	5.4
Morocco	1.5	1.5	1.5
Nigeria	6.6	6.6	
Total	96.7	96.7	64.0
Free World			
Foreign	9,370.1	9,309.5	8,416.7
United States	7,136.0	6,984.0	6,929.0
Total	16,506.1	16,293.5	15,345.7
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	224.0
Russia	2,260.0	2,260.0	2,070.0
Others	60.0	60.0	50.0
Total	2,555.0	2,555.0	2,344.0
WORLD TOTAL	**19,061.1**	**18,848.5**	**17,689.7**

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies.

†Includes estimated 3,300 bbl. daily from Naft Khaneh field, operated by Iraq government.

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking.



Pact Insures New Development

. . . of Assam fields, stepped up exploration and refining activity. Demand of 800,000 bbl. daily by 1975 seen.

INDIA'S oil industry has opened a new chapter with a formal agreement between the government and Assam Oil Co.

The agreement smooths the way for joint development and transportation of crude from fields in northeastern India. It also means that the government and private oil interests have come to terms in the free world's most populous country—and one of its newest.

A lack of indigenous oil has been one of the many problems that has made the job of running a country of 400 million people formidable. India in recent years has shunned the policy which to oil companies is obviously the most beneficial to the country, making exploration attractive to foreign firms.

But the 9-year-old government has had to feel its way as it was bombarded with every shade of political idea from every quarter, including Russia and Red China. India's decision to work in partnership with the Burmah Oil Co. subsidiary shows that it still is willing to sit down at a table with private companies.

Oil India Private, Ltd. . . . At stake were Nahorkatiya, Hugrijan, and Moran fields in upper Assam. Reserves in hand can sustain a production of 50,000 bbl. daily. Forty of 48 wells drilled in the three fields are producers.

Oil India Private, which has been incorporated at Shillong as a rupee company, will produce the oil and deliver it to refinery terminals. The government will have one-third interest, and Burmah Oil, two-thirds. The board of directors consists of W. P. G. MacLachlan, chairman, K. K. Sahni, Rana K. D. N. Singh, K. B. Kanuga, R. W. Wachter, and G. N. S. Robertson.

Two refineries are planned to process the crude, one in Assam, the other at Barauni, Bihar. The government will own both plants.

Exploration at Nahorkatiya dates back to 1925, when a gravity survey was carried out by Assam Oil—long before any oil fields had been discovered with the help of this method anywhere. The survey indicated that wells deeper than 10,000 ft. would be needed, and drilling had to wait until techniques made 2-mile deep holes feasible.

After further delay caused by World War II, Nahorkatiya 1 was started in 1952 and brought in a discovery. Of the 37 field wells, five were dry, and two are mainly gas producers. Drilling time has been trimmed steadily. Nahorkatiya 38 was completed at 10,337 ft. in 18 days.

Background . . . India in the next few years may be one of the world's fastest growing marketing areas.

Optimistic local forecasters predict demand in 1975 to run as high as 700,000 bbl. to 800,000 bbl. daily. This would be a seven or eight-fold increase over present consumption of 100,000 bbl. to 120,000 bbl. daily. If the forecast is accurate per capita consumption in 1975 still will be less than 34 gal. per year. This compares with present per capita consumption of 620 gal. in the U. S., and 120 gal. in England.

Despite the growth potential and promising acreage, oil companies and the government have not eagerly sought each other. The controlling political party, headed by President Nehru, is on record as favoring gradual socialism. All further exploration will be carried out by rupee companies in which the government has majority interest. On the other side of the ledger, the government has said it would not take over by totalitarian methods.

The Russians . . . India is actively pushing its own exploration program in the western part of the country. Turbo-drilling equipment and crews are being supplied by Romania and Russia.

The Communists have regularly underbid U. S. and western European firms. India, as a neutralist nation, has accepted. There is little doubt that Communist under-bidding was motivated by political reasons.

The Oil and Natural Gas Commission so far has found gas at Jawalamukhi, in Punjab. Two wells have hit shallow gas pockets in the Cambay area, 240 miles north of Bombay. A Russian expert estimates reserves in the Cambay area at more than 200 million barrels, on the basis of coring and seismic work. The government is extending its program into Assam, where a well is getting under way at Sibsagar.

Romanians will build one, and possibly both of the refineries in Assam. The plants will be of U. S. design. But the Romanians won the contract on the basis of favorable credit and price.

Stanvac's search . . . The only exploration program being carried on by a private company today is a Standard-Vacuum search in eastern India.

Stanvac acquired a 10,000-sq. mile concession in the Bengal basin before the government's new policy took effect. The government has had 25% interest in the operation from the start.

Stanvac started its sixth wildcat January 14. The well, Ranaghat 1, is drilling ahead at 6,975 ft. The first five wells were dry. The company has two seismic parties in the field.

D&S First in . . .

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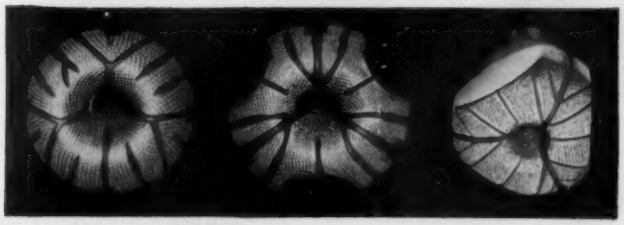

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Gas Reaches Britain

. . . to complete first ocean voyage of a cargo of liquid methane. More trials to follow, then a fleet of ships.

THE PIONEERING Methane Pioneer, its first voyage to England a success, is just the first and smallest of a number of methane-carrying ships to be built for a potentially great new industry.

Continental Oil Co. said last week the Methane Pioneer is "merely a prototype of larger vessels to be used in liquid methane service."

It will make a few trial runs to England to demonstrate the practicability of shipping low-temperature liquids by tanker.

Continental is joint owner of Constock International Methane, Ltd., with Union Stock Yard and Transit Co. of Chicago. Constock and British Methane, Ltd., formed by the Gas Council of Great Britain, own and operate the 5,000-ton Methane Pioneer.

The importance . . . Constock President E. F. Battson was jubilant at the first transocean delivery of liquid natural gas in history.

"Success of the first voyage of the Methane Pioneer marks the beginning of an era when gas for use as domestic and industrial fuel can be made available to energy-deficient countries throughout the world," Battson said.

"In some parts of the world natural gas is a wasted natural resource, and the success of this program to transport it in the form of liquid methane is a tremendously significant technical achievement and a boon to the economy of many countries."

The voyage . . . The Methane Pioneer arrived in England after a 3-week voyage from Lake Charles, La.

The trip had both good and bad weather. The roughest period was near the Azores. The ship completed the voyage without mishap.

It docked at a terminal on Canvey Island between London and Southend with its cargo of 32,000 bbl. of liquid methane.

The return voyage is expected to start this week. Seven American and British engineers and 29 British seamen made the maiden voyage to England.

The ship is managed and operated by the 230-year-old Stephenson Clarke, Ltd., London, largest fuel shipping organization in the United Kingdom.

The engineers kept a close eye on the cargo tanks, insulation, and the cargo itself to determine its behavior under ocean conditions.

Development . . . Constock has spent the last 5 years developing its plans for ocean shipment of methane in a liquid state without pressure.

The methane is carried at −258° F. in five special aluminum tanks installed in insulated holds of the ship.

Constock says it "holds a strong patent position" established during its years of development work.

Battson said British Methane, Ltd., spent more than $5 million on the Methane Pioneer and that Constock invested some $5 million in the pilot liquefaction plant and terminal at Lake Charles, which supplied the gas for the first trip.

The North Thames Gas Board spent another $1 million for the Canvey Island terminal and for reforming facilities at its Romford gas works.

The cargo was transferred from the ship to storage tanks at Canvey Island and subsequently will be vaporized to gas under pressure and delivered to the reforming plant.

There it will be mixed with refinery off-gases and the mixture reformed to town gas and delivered to Thames Gas Board's consumers in the London area.

WORLD BRIEFS . . .

An 80,000-bbl. distillation unit has been placed on stream at the Shell Haven refinery of Shell Refining & Marketing Co. in England. It raised capacity of the plant to 160,000-bbl. daily.

A refinery may be built in Morocco by the Italian State Oil Agency. Reports from Paris indicate ENI and the Moroccan Government have signed an agreement for a 24,000-bbl. plant.

Shows are reported in two Libyan wildcats. Royal Dutch-Shell is testing a show at 6,696 ft. in a well at Bir Tlatsin, 125 miles south of the Mediterranean coast. The French company, CPTL, has a show in Ulet Sheppi, 75 miles from the coast in Tripolitania. Tests now are being made at 3,500-3,540 ft.

The Tidewater-Atlantic-Texaco Group has found a show of oil in an Upper Cretaceous limestone at 7,500 ft. in its 1 Ebyat wildcat in southeastern Turkey. The show may be from the zone found productive by Atlantic at Karatchok field in Syria. The 1 Ebyat is about 35 miles northwest of Cizre. The well last week was drilling ahead at 8,700 ft.

Contract for an 18-in. crude pipeline from Block 1 in Lake Maracaibo to a terminal at Punta Palmas has been awarded to J. Ray McDermott & Co. by Venezuelan Sun, the operator for a three-company group. The line will eliminate the need to barge crude to the western side of the lake.

Talks are in the early stages for a 500-mile pipeline from Karshuk field in Syria to the Mediterranean. United Arab Republic is carrying on the negotiations with the West German firm of Mannesmann.

If the Japanese Government approves, a trading firm will import a trial shipment of 115,000 bbl. of Russian crude from a Black Sea port in March. Sogo Boeki Kaisha won a price-cut from Soviet Oil Export Corp. to cover the long ocean haul in Japanese tankers. Price will be $14.25 per ton.

The Rotterdam-Rhine Pipeline has awarded contracts to Associated Pipe Line Contractors to build its crude line from Rotterdam into West Germany. The project includes 59 miles of 30-in. and 96 miles of 24-in. from Rotterdam to Godorf and Wesseling, and a 25-mile smaller line to a Gelsenkuchen refinery.

An offer to invest $5 million in the Swiss Exploration program has been withdrawn by Standard Oil Co. (N.J.). The company also gave up an option to participate in a possible concession in the Canton of Bern for the reason that local oil legislation is too uncertain.

Atlantic Refining Co. and partners have spudded in a wildcat in the Peten area of Guatemala. It is the 1 San Francisco, about 12 miles southwest of Flores. Partners include Tidewater, Sohio, Union, and Standard Oil of California.

HYDROFINING REPLACES ACID TREATMENT

To eliminate pollution of air and effluent water, reduce operating costs, and to produce a sulphur free finished product, a large Gulf Coast refiner recently placed in operation the above pictured 6000 barrel per day HYDROFINING Unit designed to supplant acid treatment in processing close boiling range naphthas.

Feed stock is vaporized and mixed with hydrogen which catalytically reacts with sulphur contained in the feed stock mostly in the form of mercaptans, to form hydrogen sulphide which is further processed to recover elemental sulphur. After HYDROFINING the liquid product is washed with caustic and filtered through charcoal.

HUDSON furnished mechanical design, materials and equipment; and constructed the HYDROFINING Unit and the Fractionating Unit shown at the left of the picture.

The services of the HUDSON organization, with over 25 years experience in process design, mechanical design and construction are available to process industries in any part of the free world.

DESIGNERS AND CONSTRUCTORS OF PROCESS PLANTS FOR THE OIL, GAS, CHEMICAL, AND MINERAL INDUSTRIES

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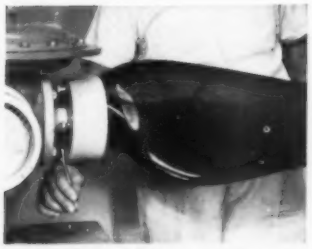
Lightweight.



Easy installation and adjustment.

NEW HUDSON TUF-LITE FANS

After six years of development work and tests of trial field installations operating under wide ranges of conditions in cooling towers, finned tube coolers, and in highly corrosive chemical plant ventilating service, Hudson presents a new product—the TUF-LITE fan. The blades, cast in one seamless piece of fiber glass reinforced synthetic resin, are hollow, light and tough. TUF-LITE fans afford the following advantages over any other available type of fan:

SAFE: TUF-LITE blades being lightweight (about ¼ the weight of other blades with comparable capacity) and infrangible, eliminate the hazards to personnel and equipment existent through accidental throwing or disintegration of heavy metal, wood, or laminated blades while in service.

EFFICIENT: More air is moved at less horsepower because weight and finishing operations do not impose limitations on selections of best aerodynamic design; therefore nearly ideal airfoil cross sections, commercially attainable only in TUF-LITE blades, can be used. Blades will not sag or distort, and surfaces remain permanently smooth.

LOW MAINTENANCE: TUF-LITE blades are unaffected by corrosive, abrasive or impingement effects of hot saturated air, sand, rain, or hail, and have superior deterioration resistance to practically all corrosive vapors or liquids. Blade materials contain color pigment; no painting is necessary. Light weight reduces stress and maintenance on bearings, gears, drive shafts, and supports.

QUIET: The permanently smooth surfaces, very light weight, sustained perfect balance, and advanced aerodynamic design minimize noise.

EASE IN INSTALLATION: Light weight of blades and ingenious design of hub and blade coupling allows attachment of blades by one man using only small wrench. Coupling design assures uniformity of pitch of all blades, and as blades of same size are identical and interchangeable, perfect fan balance is preassured.

In replacement of present fans or in installations on new cooling equipment of any manufacture TAKE ADVANTAGE OF THE OUTSTANDING SUPERIORITY OF HUDSON TUF-LITE FANS.

Bulletin on TUF-LITE FANS
Available upon Request

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NEWEST PETROCHEMICAL COMPLEX

Beginning: A special section on

PETROLEUM CHEMICALS, INC.'S
Plant Expansion

Photo courtesy Manning, Maxwell & Moore.

Interchange of materials among various plants insures

Complete byproducts processing

There are still a few small squeals left—such as the pure (95%) oxygen, from the ammonia-plant air-separation unit, which is presently vented. Otherwise, byproduct materials which are not marketed are utilized fully in the internal processing.

THE Petroleum Chemicals, Inc.-Calcasieu Chemical Corp. petrochemical plant complex at Lake Charles, La., is designed for full processing of the refinery byproduct streams, which come from the two nearby parent-company refineries and serve as primary feeds. In turn, each of the major plants in the complex has byproduct streams of its own which are interchanged between plants, so that with regard to byproducts the petrochemical pig is well rendered with only a few squeals left unused.

It must be emphasized, however, that the basic facilities described in this special report represent only a beginning—though a quite solid, respectable $70,000,000 beginning. Petroleum Chemicals, Inc., has undertaken an expanded research program under a development department consisting of research, project analysis, and market-research divisions. Further diversification, as time goes on and circumstances permit, may be expected as a matter of course.

BY H. S. BURK
Superintendent, Technical Services

and

I. E. THIBODEAUX
Chief Plant Chemical Engineer,
Petroleum Chemicals, Inc.

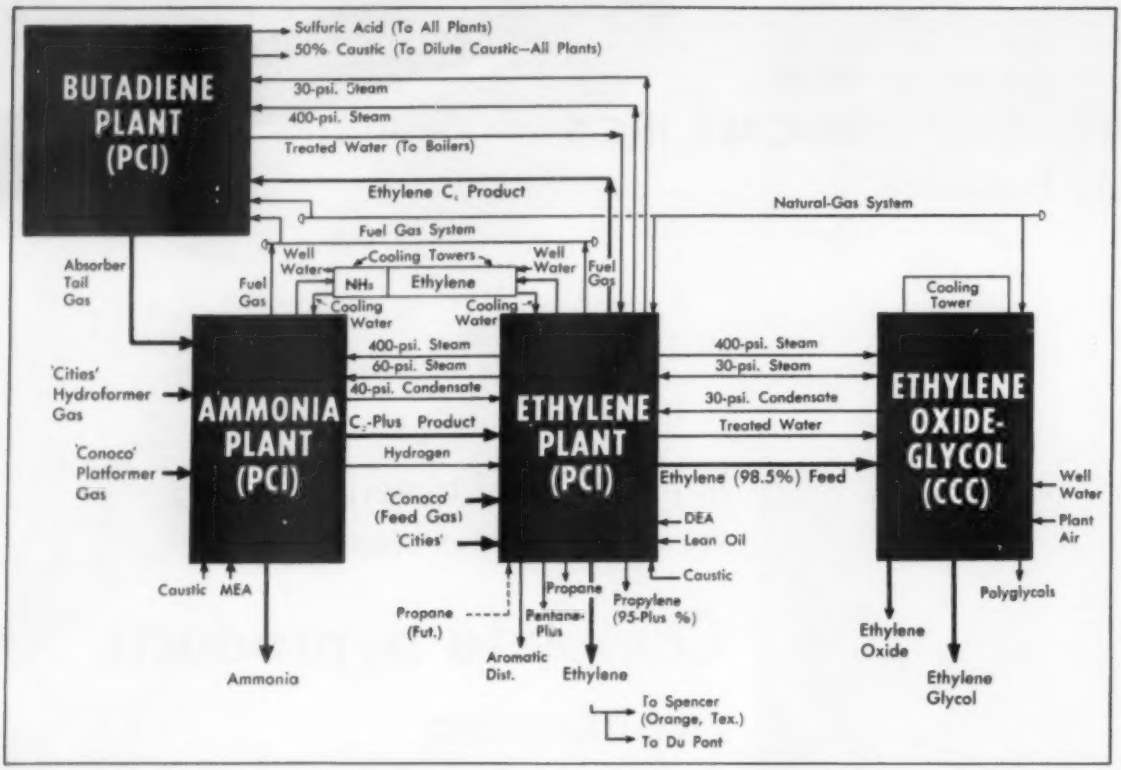
The butadiene plant receives a B-B stream as feed from the adjacent Cities Service Refining Corp. refinery. This is supplemented by a C_4's stream coming from the ethylene plant. Butadiene manufacture and the expansion of the PCI butadiene plant have been dealt with elsewhere.[1,2] Processing follows these basic steps:

1. **Removal of isobutylene** by the sulfuric acid process and polymerization, with polymers returned to Cities Service.

2. **Feed preparation** using acetone extractive distillation (for separation of saturates from unsaturates).

3. **Dehydrogenation** of n-butylene to butadiene by the steam dilution

NEWEST PETROCHEMICAL COMPLEX



PLANT INTERTIE—A C_4's stream from ethylene processing goes back to the butadiene plant. A hydrogen-rich expander offgas (not shown in the diagram) is also available from the ethylene plant and this is routed either to the ammonia plant or to plant fuel. High-purity (99.7%) ethylene goes by pipeline to consumers in Orange, Tex.

method followed by a gas recovery and fractionation.

4. **Butadiene purification** by extraction with cuprous ammonium acetate in a mixer-settler system to make 98 plus wt. % butadiene.

A byproduct stream from the butadiene plant is the hydrogen-rich stream from the gas-recovery section (absorber offgas). This is routed to the ammonia plant.

The ammonia-plant feed therefore consists of: (1) Hydroformer gas from Cities Service, (2) Platformer gas from Continental Oil Co., and (3) the dehydro absorber gas from the butadiene plant which is a supplementary or trimmer feed.

Combinations of these streams go to the low-temperature separation unit in the ammonia plant. The LTSU produces pure hydrogen for ammonia synthesis. (An air-separation unit in the ammonia plant supplies pure nitrogen for the synthesis; oxygen from this unit is presently vented).

The LTSU also produces these byproduct streams: (1) a methane-rich stream used as fuel gas, and (2) an ethane-and-heavier stream, carrying some ethylene, which goes to the ethylene plant. A small stream of hydrogen is also sent from the ammonia plant to the ethylene plant (for regenation of acetylene hydrogenation catalyst, in the ethylene-plant feed purification section).

The ethylene-plant feed consists primarily of refinery byproduct gas—a stream rich in ethane and ethylene from Cities Service, and another stream from Continental. This is supplemented by the ethane-ethylene-and-heavier stream from the ammonia-plant LTSU. The ethylene plant is designed to make high-purity ethylene from these three vapor-feed streams and a (future) liquid propane feed.

Byproduct streams from the ethyl-

BUTADIENE PURIFICATION SECTION of PCI's 80,000-ton per year (rated capacity) plant. A major portion of the butadiene goes to the nearby Firestone SBR (styrene-butadiene rubber) copolymer plant.

ene plant include: (1) demethanizer offgas which goes to plant fuel, (2) a C_4's stream (debutanizer overhead make from ethylene fractionation section) which is a butylene-plus-butadiene-bearing stream that is routed to the butadiene plant, and (3) a hydrogen-rich expander offgas to the ammonia plant or to plant fuel. Additional (marketable) byproducts from this plant include: propylene, propane, a C_5-and-heavier stream, and aromatic distillate.

The ethylene plant is designed with initial capacity of 200,000,000 lb. per year. This amount of ethylene can be made either as all high-purity (99.7% or above) ethylene, or as a combination of high-purity and low-purity (98.5%) ethylene.

The plant is designed for a propylene purity of 95%.

The basic design contemplates future expansion to increase ethylene production to 300,000,000 lb. per year. The expansion can be accomplished with only minor changes, with the exception of required additional cracking heaters. All towers, tanks, and piping are designed for this ultimate capacity.

The ethylene plant includes these basic sections:

1. **Cracking and quench,** with four cracking heaters presently in operation (three on ethane and one on propane).
2. **Heater effluent-feed gas treating,** which section includes the acetylene converters and an amine and caustic treating system.
3. **Drying,** which includes guard dryers for C_2-and-lighter.
4. **Recovery,** which consists of: (1) the gas fractionator—this makes the primary split between the C_2's-and-lighter and the C_3's-and-heavier, (2) the C_3-C_4 recovery, consisting of depropanizer and debutanizer, (3) propylene fractionation and refrigeration system, (4) ethylene fractionation and refrigeration system, and (5) demethanizer and methane refrigeration system.

The three major compressor groups in the ethylene plant are driven by 12,500-hp. gas turbines. Three waste-heat boilers are an integral part of the ethylene plant. Each boiler is designed to operate on the exhaust gas from any one of the three gas turbines: (1) as waste-heat boilers only on the gas-turbine exhaust, or (2) supplementary fired with fuel gas using the excess oxygen in the turbine exhaust gas to a rating of 215,000 lb. per hour for each boiler. In addition, each boiler is equipped with proper duct and damper arrangement to operate independently of the turbine exhaust on forced-draft fan air. The boilers produce 450-psi. steam at 650° F. total temperature. The ethylene plant thus provides 400-psi. and 30-psi. steam for all the plants from its waste-heat boilers.

High-assay ethylene goes to the Du Pont and Spencer polyethylene manufacturing facilities at Orange, Tex. These companies are supplied by a 6-in. high-pressure pipeline; this line has been adequately sized to provide ethylene to any future customers in this area.[2]

Feed to the **ethylene oxide-glycol plant** is low-assay ethylene. This Calcasieu Chemical Corp. plant employs the Shell Development direct-oxidation process using oxygen. The air-separation plant here is of a different type from that in the ammonia plant, designed to make high-pressure oxygen. At present essentially all the ethylene oxide is used to make ethylene glycol.

Some facts and figures on PCI-CCC

Ownership:

Petroleum Chemicals, Inc., is owned jointly by Cities Service Oil Co. and Continental Oil Co.

Calcasieu Chemical Corp. is operated by PCI and owned by Continental Oil, Cities Service, Mineral Industries, Inc., and Sears, Roebuck & Co.

Source raw materials:

Continental refinery at Westlake and Cities Service refinery at Lake Charles.

Original facility:

Butadiene plant was bought from Government in 1955 and expanded from 65,500 to its present rated capacity of 80,000 tons per year at a total cost of $22,500,000. A butylenes feed stream comes from Cities Service refinery. Main butadiene customer is adjacent Firestone copoly plant.

New plant facilities:

These all came on stream during 1958:

Plant—	Initial capacity	Ultimate capacity	Cost (including off-site facilities)
Ethylene (PCI)	200,000,000 lb./yr.	300,000,000 lb./yr.	$22,500,000
Ammonia (PCI)	100,000 tons/yr.		$13,250,000
Ethylene oxide	*57,000,000 lb./yr.		$10,000,000

*Or 8,000,000 gal./yr. ethylene glycol.

Key PCI executive and operating staff:

Bruce K. Brown	President
F. M. Simpson	Executive vice president
B. R. Johnstone	Secretary and treasurer
J. H. Olehy	General manager, manufacturing department
H. L. Malakoff	Manager, development department
T. M. O'Neil	General manager, sales
L. D. Grubb	Regional manager of manufacturing

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2. Reidel, J. C., "Butylene Dehydrogenation by Steam Dilution Method," and "Feed Preparation and Butadiene Finishing . . .," ibid., Dec. 2, p. 87 and Dec. 16, p. 110 (1957).
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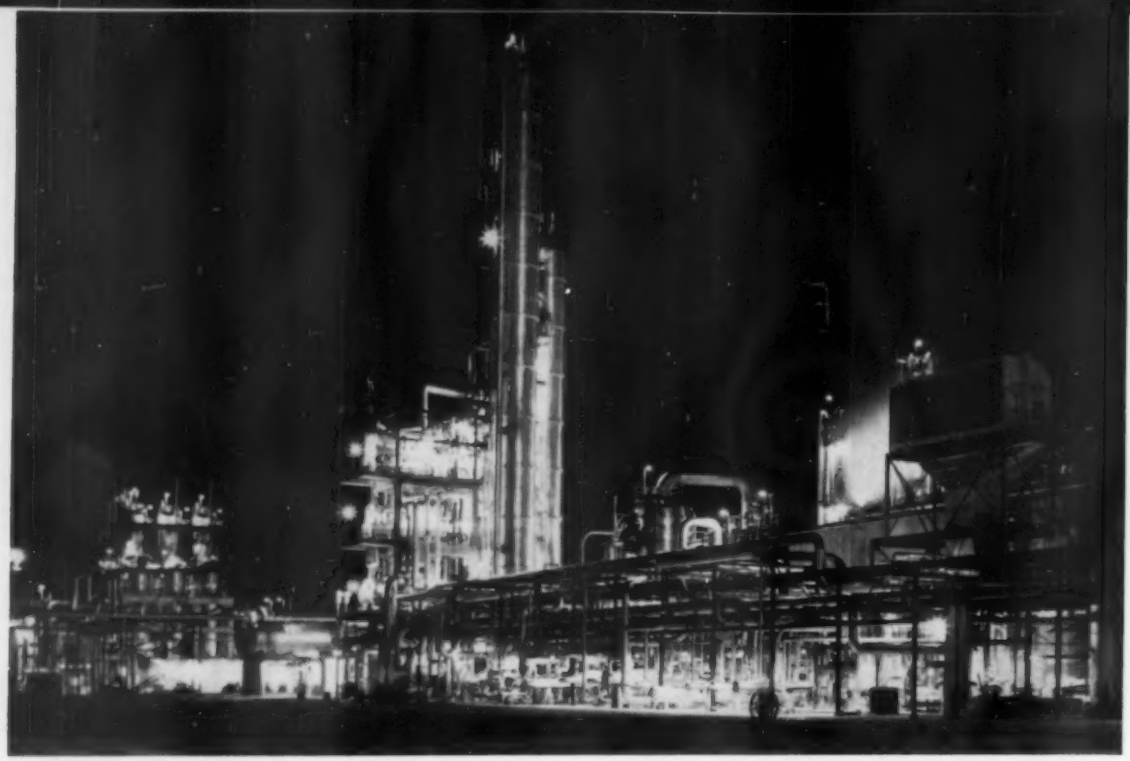
4. Anon., "Dual-Purpose Pipeline . . . High-Purity Ethylene," The Oil and Gas Journal, Feb. 10, 1958, p. 100.



ETHYLENE AND PROPYLENE FRACTIONATORS—These appear in this night view of the PCI ethylene plant at Lake Charles, La. The refrigeration section, gas turbine air intake, and steam-generating units are shown also.

NEWEST PETROCHEMICAL COMPLEX

PCI's ethylene plant features

High-efficiency, low-temp process

High-purity (99.7-plus %) ethylene is made with single demethanizer and single ethylene fractionator. Plant has consistently exceeded specified ethylene purity. Offgases are produced in two streams, one rich in hydrogen and the other in methane.

BY WILLIAM TUCKER
Lummus Co., New York,
C. G. KEVIL
Operating Superintendent, Ethylene and Ethylene Oxide, and
P. M. ABLESON
Process Superintendent, Ethylene,
Petroleum Chemicals, Inc.,
Lake Charles, La.

THE most important facility in the PCI expansion program is the ethylene unit. This is not only because of the size of the plant but because the ethylene produced is the feed stock for plants representing several times the ethylene-plant investment. PCI therefore laid down stringent requirements for its first ethylene plant by way of: (1) reliability, (2) flexibility, (3) safety, and (4) economy.

The plant supplies ethylene to at least three different users and continuity of supply is essential. The 30-mile pipeline to Orange, Tex., operates at pressures between 400 and 1,000 psig. This represents a certain amount of product surge capacity and for the initial stage of its program PCI did not include the installation of large-scale (15 to 30 days') ethylene product storage. However, underground salt dome storage is now being developed.

The ethylene purity to the pipeline is guaranteed at 99.7%. Although many operating plants produce ethylene of this purity, the PCI plant is the first to market this material to outside consumers. This product specification leaves little margin for error. Feed stocks for the unit are provided by three plants and are subject to all the variations and interruptions normal to operation of these plants. Consequently the second requirement is flexibility to maintain ethylene production and purity in spite of wide and rapid swings in feed quantity and composition.

The plant must hold its own in the highly competitive Gulf Coast ethylene market. Presently installed and projected ethylene capacity in this area assures an excess of production over supply for the next few years. To operate at the proper economy level, plant capacity had to be the maximum permitted by the marketing forecasts. It also meant a high-efficiency process route and utilization of the latest developments in mechanical equipment and automatic control.

In a sense safety is an integral part of plant reliability. Even a relatively minor fire or other mishap can result in down time which would be intolerable to the ethylene user. Any large

ETHYLENE PROCESS CONTROL—Stream analyzers include infrared analyzers taking samples from: (1) a tray in demethanizer, (2) a tray in ethylene fractionator, (3) top tray of propylene fractionator, and (4) overhead of ethylene fractionator.

light-hydrocarbon operation is inherently hazardous and the strictest precautions must be taken in design, in materials control during construction, and in operating procedures. In large modern plants particularly where, for example, spare refrigeration compressors are not provided, it becomes imperative to be able to quickly dispose of large accumulations of vapors without overpressuring the equipment.

1—LOW-PRESSURE, LOW-TEMPERATURE FRACTIONATION PLANT

A contract was let to Lummus Co. to engineer and construct a plant for an initial capacity of 600,000 lb. per day of ethylene with facilities to permit rapid expansion to an ultimate capacity of 900,000 lb. per day. Ethylene is produced in two grades, with the high-purity grade set at 99.7% purity and the other grade at 98.5%. In addition, facilities are provided to produce a propylene product with purity above 99%.

Feeds for the initial production are provided from the nearby refineries of Cities Service Refining Corp. and Continental Oil Co. and from PCI's adjacent ammonia plant. Typical analyses of these feed streams are shown in Table 1. Basically the plant recovers C_2's and heavier from these gases; recycles the ethane and propane to the cracking furnaces; and delivers ethylene, propylene, fuel gas, and C_4 and C_5 products. Feed stock for the additonal production to 900,000 lb. per day will be either ethane or propane from other sources.

The selection of the processing route was the result of an exhaustive comparison of the many schemes in commercial use and various designs developed by Lummus Co. The major distinction used in classifying separation processes is the demethanization technique employed. Discussions of this subject are contained in the papers by Fair, Nisbet, and Bolles[1] and Schutt and Zdonik.[2] The recovery section of the PCI plant consists of:

1. Fractionation to separate C_3 and heavier from C_2 and lighter materials.
2. Low-temperature condensation at high pressure to liquefy all of the C_2's.
3. Demethanization of the condensed liquid at low pressure.

The PCI plant would thus be classified as a low-pressure, low-temperature fractionation plant. (See flowsheet).

Process advantages . . . In addition to high thermal efficiency (low refrigeration and reboil heat requirements) the process has two notable advantages over more conventional schemes. The first is that high-purity ethylene (99.7 plus %) is produced with a single demethanizer and a single ethylene fractionator. No rerunning or topping facilities are required. The second is that the offgases are produced in two streams, one rich in hydrogen and the other in methane. For example, at PCI the hydrogen-rich stream has a hydrogen content of approximately 75%. The methane-rich stream is approximately 95% methane. Both these purities may be increased by relatively minor modifications if necessary for use in further processing. The process also has unusual operating stability in that the demethanizer is fed with liquid only and can therefore be insulated from sudden change in feed composition or compression system upset.

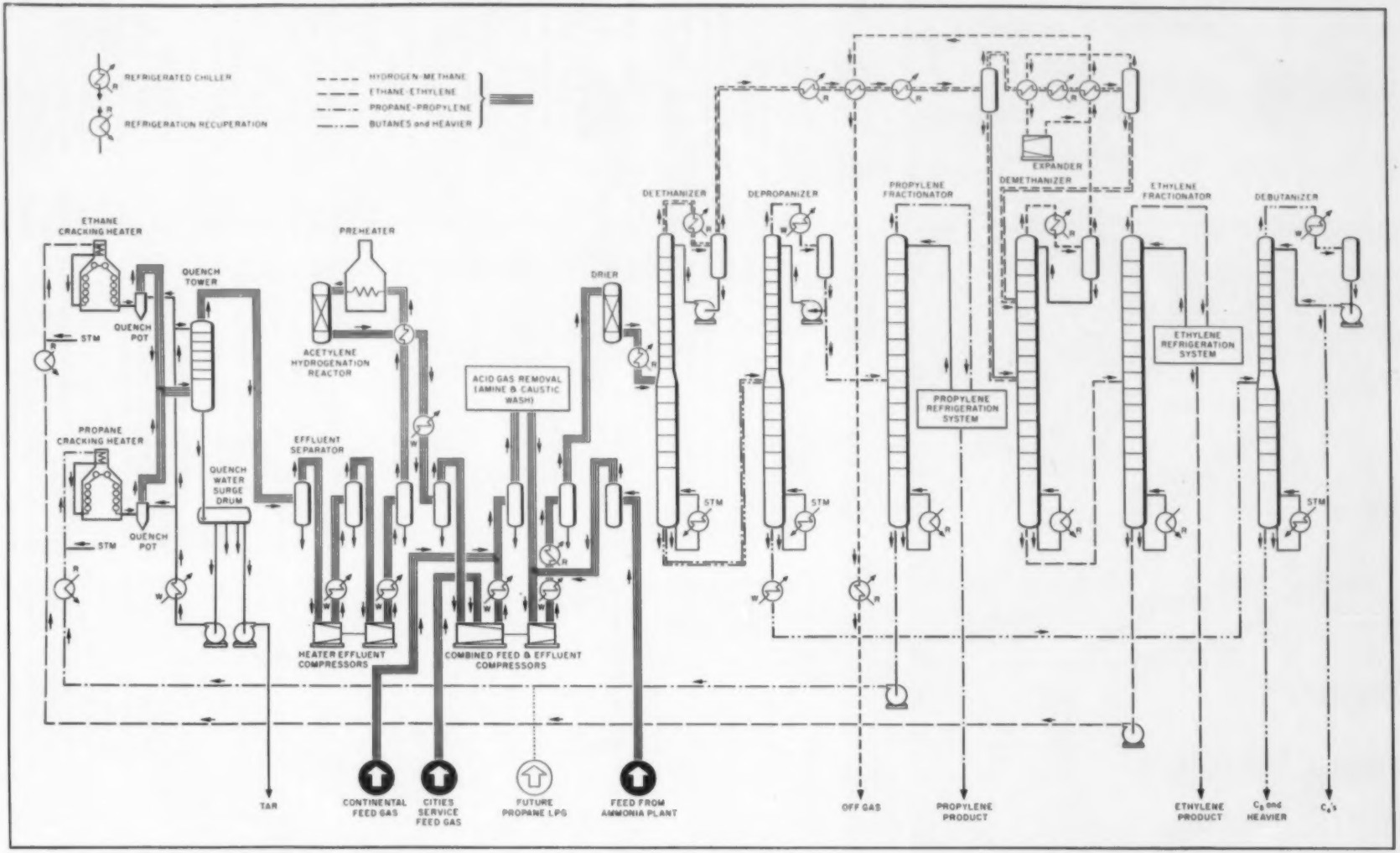
2—ETHANE AND PROPANE PYROLYSIS

Ethane and propane are separately cracked in four tubular furnaces. The furnaces are all identical and each furnace is equipped to handle either cracking stock. In the initial operation three furnaces normally charge ethane and one charges propane. The furnaces are of a two-radiant-section design with a convection section for preheat. Convection section tubes are of carbon steel except for the last two rows which are exposed to the radiant section and are of Type 304 stainless steel. The all-welded radiant coil is also of Type 304 stainless steel, except for the last 10 tubes which are of Incoloy. The welded return bends are entirely inside the firebox. The furnaces are all gas fired; a multiplicity of premix-type burners assures uniform heating.

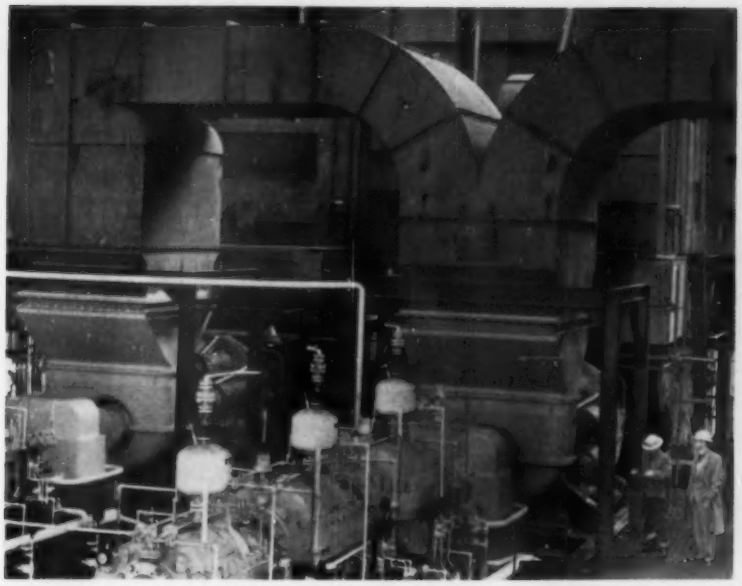
Cracking

Ethane is cracked at 60 to 65% conversion per pass and propane at 80 to 85% per pass. Dilution steam is added at the heater inlet to control partial pressure and suppress coke formation. Outlet temperature is approximately 1,525° F. for ethane and 1,490° F. for propane. The heater

ETHYLENE PROCESS SCHEME



THE RECOVERY SECTION of the PCI plant consists of (1) fractionation to separate C_3 and heavier from C_2 and lighter, (2) low-temperature condensation at high pressure to liquefy all of the C_2's, and (3) demethanization of the condensed liquid at low pressure.



THE THREE MAJOR COMPRESSOR GROUPS in the ethylene plant are driven by 12,500-hp. gas turbines. Three waste-heat boilers are an integral part of the ethylene plant. Each boiler is designed to use the exhaust gas from any one of the three gas turbines.

effluent is water quenched in special fittings at the outlet of each furnace to approximately 600° F.

Quench . . . The heater effluents are then combined and cooled in the quench tower to 100° F. or less. The quench water is cooled to 130° F. in air-fan-cooled exchangers and circulated over the lower section of the tower which is grid packed. A portion of the quench water is further cooled against cooling water and then used to vaporize propane charge to the cracking heater. This subcooled water circulates to the upper portion of the quench tower and assures a minimum gas temperature to the charge compressors. This upper section of the tower is equipped with valve-type trays to assure efficient contact over a wide range of throughput rates. Hot quench water from the bottom of the quench tower passes to a quench water settler where a small amount of sludge consisting of tar and coke particles is settled out. Lighter-than-water aromatic and naphthenic oils are decanted and pumped to storage.

3—HEATER EFFLUENT - FEED GAS COMPRESSION

The ethylene compressor platform mounts three trains of centrifugal compressors. Each of these trains is driven in tandem by a combustion gas turbine through a speed increaser. The first train handles the heater effluent together with the fresh feed gases from an inlet pressure of 9 psig. to 525 psig. in four stages. (The first two stages handle effluent only and the feed gases are introduced at the pressures at which they are available). The other two compressor trains handle ethylene refrigeration gas and propylene refrigeration gas, respectively.

Compression ratios . . . The heater effluent-feed gas compressor train consists of four multistage compressor casings in tandem. Compression ratios are kept low to hold low compressor outlet temperatures and avoid polymerization in the compressor. This is particularly important in the first two stages where the heater effluent is undiluted by the feed gases. The polymerization problem is not very severe when ethane only is cracked, but becomes more significant in handling of propane, propylene, and heavier stocks.

The gas is cooled between casings. Maximum allowable gas temperature for each casing was specified at 220° F. To meet this requirement interstage spray nozzles were furnished for water injection on the first, second, and fourth-stage compression casings.

An oil wash spray also is injected into the suctions of the first and second-stage compressors. The oil spray keeps the wheels wet and prevents polymer from forming and sticking to the wheels and passages in the compressor. Water-cooled intercoolers and knockout drums are of course provided between each stage.

4—HEATER EFFLUENT PRETREATMENT

After the second stage, the heater effluent is treated for acetylene removal. The gas is heated by exchange and by a separately fired preheater and then passed over beds of hydrogenation catalyst where the acetylene concentration is reduced to meet a maximum specification of 50 p.p.m. in the ethylene products. The feed gases contain practically no acetylene and are not treated for acetylene removal.

The catalyst must be regenerated periodically and facilities for polymer burnoff with steam and air and reduction with hydrogen are provided. For a discussion of this and other acetylene-removal techniques reference is made to the paper by Reitmeier and Fleming.[3]

The heater effluent contains CO_2 and the two refinery feed streams contain both CO_2 and H_2S. These are removed in a conventional amine system followed by caustic and water wash. CO_2 and H_2S in the ethylene product do not exceed 3 p.p.m. The ammonia plant feed is free of acid gases and does not require treatment.

After compression to 525 psig., the combined heater effluent is water-cooled and chilled with propylene refrigeration to about 60° F. or just above the hydrate formation point. The liquid and vapor phases are separated, water decanted, and the hydrocarbons dried in the liquid and vapor driers. Activated alumina type F-1 is used as the desiccant. The system is conventional with two dryer cases operated in series while one case is being regenerated. Natural gas is circulated in a closed system over a fired heater for regeneration.

5—FRACTIONATION SYSTEM

Typical analyses of significant streams in the fractionation system are shown in Table 2.

The dried vapor feed is further chilled and the liquid and vapor streams are charged to the appropriate decks in the gas fractionator, more properly called the deethanizer. Here C_2 and lighter are taken overhead and C_3 and heavier components are taken as bottoms. The tower operates at 490 psig. The bottoms temperature is below 200° F., and polymerization in the reboiler is not a problem. The overhead product is taken forward as a vapor to the low-temperature gas-chilling train. Reflux is condensed against propylene refrigeration.

C_2 and Lighter Processing

The gas-fractionator overhead vapor containing H_2, CH_4, and essentially all of the ethylene and ethane is

ETHANE AND PROPANE are cracked separately in four tubular heaters. These are of a two-radiant-section design with convection section for preheat.

further chilled by propylene and ethylene refrigeration and by exchange against offgas to minus 130° F. At this point 95% of all the C_2's are liquefied together with a substantial amount of methane. The two phases are separated and the liquid charged to the demethanizer. The vapor is further chilled against offgas and methane refrigeration to minus 190° F. and the phases separated. At this point C_2 recovery is essentially complete, the offgas containing less than 0.6% ethylene. The liquid is charged to the demethanizer and the vapor is reheated against feed and expanded through turbo-expanders.

Expanders . . . Two high-efficiency, high-speed expanders in series are used with reheat between stages for maximum refrigeration effect and to prevent liquid formation in the expanders. The expanders are loaded by low-pressure air blowers. After the offgas is reheated to ambient temperatures it may be sent to the ammonia plant where the high hydrogen content can be utilized, or it may be rejected to the low-pressure fuel system at 65 psig.

The demethanizer, operating at 75 psig., is essentially a stripping column, reducing the methane concentration of the bottoms to less than 0.1% referred to ethylene. This is easily accomplished since the relative volatility is high at this low pressure. A plot of relatively volatility for the CH_4-C_2H_4 system at various pressures is given in the paper by Fair et al.[1] Only a very small amount of reflux is required in the rectification section to reduce the ethylene content in the overhead to less than 0.5%.

Hold demethanizer steady . . . It will be noted that the demethanizer is fed from two liquid surge drums and can therefore be held at steady operating conditions. Changes in feed composition and fluctuation in the compression system can thus be smoothed out and the tower specifications more easily maintained. The overhead temperature of the tower is minus 210° F. The overhead vapors are reheated against methane compressor discharge and are compressed in a three-stage electric-motor-driven centrifugal compressor. The net methane overhead is withdrawn to either the low or high-pressure fuel-gas system. The circulating methane stream after compression is returned as reflux and as methane refrigeration for the last stage of feed chilling described above. Since the demethanizer bottoms are free of C_3 the temperature is low, and reboiling is accomplished by condensing ethylene refrigerant. The bottoms temperature varies with the ethylene-ethane ratio but is in the order of minus 70° F.

The demethanizer bottoms are now flashed into the ethylene fractionator operating at 50 psig. The fractionator operates with a heat pump and the heat pump and ethylene refrigeration loads are combined in a single compression system.

Ethylene refrigeration . . . The ethylene compressor consists of three cases in tandem driven by a single gas turbine and contains a total of 16 impellers. Ethylene refrigeration gas is handled from an inlet pressure of about 3 to approximately 400 psig. discharge. Three levels of ethylene refrigeration are provided, the lowest at minus 140° F. Overhead vapors are combined with refrigeration vapors, compressed and condensed either in the demethanizer and ethylene fractionator reboilers or against propylene refrigeration. Ethylene fractionator reflux is supplied from the ethylene refrigeration surge drum. Ethylene product is condensed at the compressor discharge, pumped to 1,100 psig., reheated, and delivered to the product pipeline. Low-purity ethylene may be withdrawn as a sidestream from the tower and delivered to the user. Ethane bottoms pass to the ethane feed surge tank whence it is vaporized and charged to the heater.

C_3 and Heavier Processing

The gas fractionator bottoms are charged to the depropanizer where the C_3's are taken overhead and the C_4 and heavier bottoms are charged to the debutanizer. In the debutanizer, C_4's are taken overhead and sent to PCI's butadiene plant. In addition to the C_4 contained in the fresh feed, this material contains the butadiene and butylenes produced in the cracking heaters. The debutanizer bottoms contain the C_5 and aromatics produced in the heater and are sent to storage.

Propylene fractionator . . . The depropanizer overhead is charged to the propylene fractionator operating at 35 psig. This fractionator also operates with a heat pump and again the heat pump and propylene refrigeration loads are combined in a single compression system. Propylene compressor consists of two machines in tandem driven by a single gas turbine, and handling the propylene refrigeration gas from inlet pressure of 6 psig. to discharge of 265 psig. The first casing is a single-stage compressor. The second casing is multistage with five impellers. Three levels of propylene refrigeration are provided, the lowest at minus 35° F. Propylene is condensed either in the propylene fractionator reboiler or against water. Propylene tower reflux is provided from the refrigerant surge drum and product is pumped from the drum to storage.

Propane bottoms are pumped either to storage or to the propane heater feed surge drum depending upon cracking requirements.

6—PLANT EXPANSION

The plant can be expanded quickly and easily from the initial production

of approximately 200 million pounds per year to ultimate capacity of about 300 million pounds per year. In order to take advantage of the economy of large exchanger bundles, the full exchanger surface is installed throughout the plant with the exception of the air-cooled quench-water coolers. The charge, ethylene, and propylene centrifugal compressors employ casings, gears, and drivers sized for future requirements. Rotors and diaphragms are designed for the initial operation in order to conserve utilities. Spare rotating elements and diaphragms, designed for future requirements, were furnished to PCI. These were provided so that when PCI decides to increase ethylene plant capacity, this can be done without delay. However, these spares can be used on the initial service conditions if an emergency arises, thus assuring PCI of complete spare rotor protection. All towers are trayed for the ultimate plant. Pump impellers are also for ultimate operation.

To expand the plant it is thus only necessary to add cracking heaters, quench coolers, and to change rotors in the compressors. Provision has been made to install the heaters and quench cooler while the plant is in operation. The only shutdown, and a short one, will be for the compressor rotor change.

Acknowledgment

Appreciation is expressed to G. D. Forristall (Beaumont) and W. J. O'Leary (New York) of Ingersoll-Rand Co. for data on compressors; and to Ivan G. Rice (Houston), J. J. Broussard (Lake Charles) and S. Beardsley (Schenectady) of General Electric Co. for data on gas-turbine drivers.

TABLE 1—FRESH FEED CASE
Mole %

Component	Conoco	Cities service	Ammonia plant
H_2S	0.9	2.7	....
CO_2	...	8.0	...
N_2	0.2	2.4	0.3
CO	....	0.1	0.1
H_2	10.0	2.6	4.6
C_1	40.3	21.5	17.0
C_2—	9.4	20.1	1.5
C_2	24.6	40.9	36.4
C_3—	6.7	0.4	1.2
C_3	6.7	0.4	30.5
C_4	1.2	0.1	1.8
nC_4	....	....	6.5
C_5	....	0.8	0.1
Total	100.0	100.0	100.0

Special Equipment Notes

1. Compressors and Drivers:

	Service	Compressors (centrifugals)	Nominal hp.	Driver
(a)	Heater effluent-feed gas	Ingersoll-Rand	13,000	GE gas turbine.*
(b)	Ethylene refrigeration	Ingersoll-Rand	12,500	GE gas turbine.*
(c)	Propylene refrigeration	Ingersoll-Rand	13,000	GE gas turbine.*
(d)	Methane	Carrier	4,000	Westinghouse electric-motor.

*These are simple-cycle, single-shaft, two-bearing design. Thermal (HHV) efficiency is approximately 20% when operating at 95° F. When used in conjunction with fired exhaust-heat-recovery boilers, over-all cycle efficiency should run between 75 and 80%. Turbines drive multistage centrifugal compressors in tandem. One unit drives four feed compressors, another drives two propylene compressors, and a third drives three ethylene compressors. Each turbine exhausts 800° F. gas to heat-recovery boilers. This gas contains some 18% free oxygen by weight which can be used to burn additional fuel. These exhaust-heat-recovery boilers produce 450-psig. steam and are each designed for 215,000 lb. per hour of steam when firing supplementary fuel in the boiler and 30,000 lb. per hour unfired. Gas-turbine units are completely base mounted. Entire assembly, with exception of control panel, is mounted on a rigid steel base which contains the oil tank and all piping and conduit. This entire unit is shipped on one freight car and measures only 37 by 10 ft.

2. Instrumentation: Manning, Maxwell & Moore electronic ("Microsen") system.

3. Analyzers: Instruments analyzing samples from demethanizer, ethylene fractionator and propylene fractionator are Mine Safety Appliances infrared analyzers.

4. Waste-heat boilers: These are conventional Babcock & Wilcox units. All-electronic instrumentation system was furnished by Manning, Maxwell & Moore.

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TABLE 2—TYPICAL STREAM ANALYSES—FRACTIONATION SECTION
VOLUME PERCENT

Stream component	Feed to gas fract	Gas fract overhead	Gas fract botts	Expander offgas	Demeth overhead	Demeth bottoms	N.P. ethylene	L.P. ethylene	Ethane to cracking	Deprop. overhead	Propylene product
N_2	0.4	0.4	...	1.1	0.6	...	...	...	...	...	...
H_2	17.7	20.4	...	74.3	4.3	...	...	...	...	...	...
C_1	20.9	24.1	...	24.0	94.3	0.02	0.1	0.1	...	...	...
C_2—	21.5	24.9	...	0.6	0.7	44.57	99.8	98.5	0.5	...	...
C_2	25.4	29.3	0.7	...	0.1	53.82	0.1	1.4	97.1	0.8	2.6
C_3—	3.8	0.3	26.3	...	...	0.55	...	...	1.8	32.4	95.0
C_3	7.7	0.6	53.3	...	...	1.04	...	...	0.6	65.5	2.4
C_4	2.2	...	16.4	...	...	...	...	...	...	1.3	...
C_5+	0.4	...	3.3	...	...	...	...	...	...	...	...
Total	100.0	100.0	100.0	100.0	100.0	100.00	100.0	100.0	100.0	100.0	100.0

A COMPACT PLANT—A single large Casale converter is employed at the PCI ammonia plant which has a rated capacity of 305 short tons of anhydrous ammonia per stream day.

NEWEST PETROCHEMICAL COMPLEX

Ammonia plant is compact, flexible

...and handles a variety of hydrogen-bearing feed streams

Maintenance of safety requirements in low-temperature processing is aided greatly by use of IR stream analyzers in air-separation unit, monitoring acetylene and other impurities in air intake and oxygen.

BY J. O. HARTMAN
Operating Superintendent

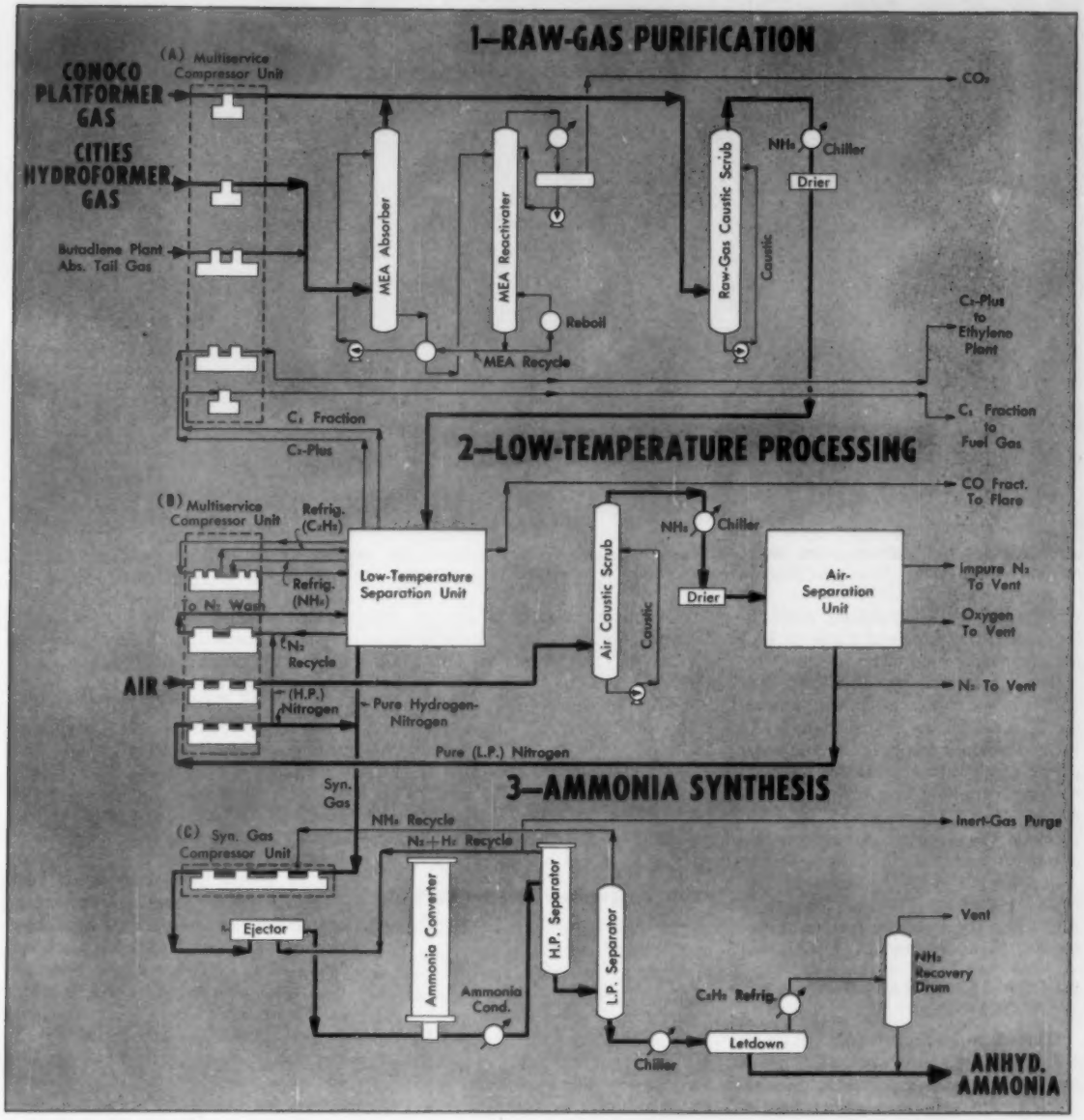
and

C. F. MACKEY
Process Superintendent,
Ammonia Plant,
Petroleum Chemicals, Inc.
Lake Charles, La.

DESIGN CAPACITY of the PCI ammonia plant at Lake Charles is 100,000 short tons of anhydrous ammonia per year. The plant has produced at this rated capacity of 305 short tons per stream day and, as an indication of its flexibility, has also produced as low as 85 tons per day in acceptance tests. Startup, which took place in the spring of 1958, was exceptionally smooth with catalyst reduction accomplished in 7 days. Foster Wheeler Corp. was contractor for this plant.

One feature of this plant is its extreme compactness, with ammonia synthesis accomplished in a single large (Casale) converter. The air-separation, nitrogen-scrubbing, and ammonia-synthesis sections are all operated from a single control room which houses a large graphic panel mounting pneumatic-type instruments. An item of interest is the board-mounted controller which operates a valve on a fresh synthesis gas feed line bypassing the Casale injector. This valve thus controls indirectly the amount of recycle entering the ejector. The nitrogen-hydrogen synthesis gas mixture is blended automatically by means of a ratio flow controller.

Another feature is the use of infrared analyzers to monitor acetylene in the butadiene feed gas; and in the air-separation plant to measure hydrocarbons in the intake air, acetylene in oxygen, and ethylene in oxygen. These analyzers have performed well in service and have contributed appreciably to over-all safety in operation of the low-temperature facilities. Another IR analyzer monitors purity of nitrogen made by the air separation plant.



AMMONIA PROCESSING—There are two compressors of each type performing these services: (A) handle each of the three feed gases separately, the methane-rich fraction from the LTSU and the ethane-plus stream from the LTSU; (B) compress air going to air-separation plant, low-pressure nitrogen, high-pressure nitrogen, refrigeration ammonia, and refrigeration ethylene; and (C) compress synthesis gas.

Hydrogen Feed Streams

Hydrogen-bearing feed streams to the ammonia plant are:

1. Hydroformer gas (from Cities Service refinery).
2. Platformer gas (from Continental refinery).
3. Butadiene absorber gas (from PCI butadiene plant).

Table 1 gives the analysis for these feed streams. A significant stream from the ethylene plant containing approximately 58% hydrogen and 42% hydrocarbons is available as supplement to the above streams.

LTSU and air separation . . . The low-temperature separation unit sometimes also called the "nitrogen scrubbing" unit since it includes a nitrogen wash tower is designed to make pure hydrogen from any combination of these feed streams. This LTSU is the largest of its type handling such a variety of feed streams. The air-separation plant, whose function is to make pure nitrogen for the liquid nitrogen scrubbing and for ammonia synthesis, is a medium-pressure-type unit featuring high over-all recovery of nitrogen.

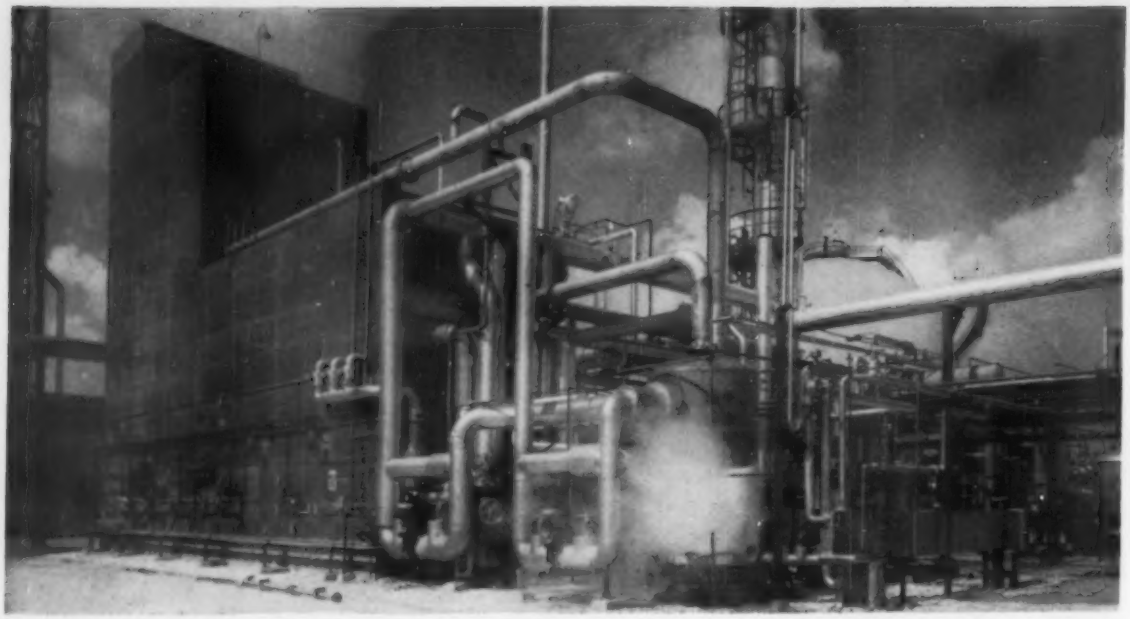
1—FEED GAS PREPURIFICATION

The three feed gases are compressed to 400 psig., the operating pressure of the feed-gas purification section.

Butadiene feed gas from battery limits is compressed in a two-stage compressor.

Hydroformer feed gas is compressed in a single stage and combined with butadiene gas to the MEA absorber for removal of CO_2. Note that butadiene feed gas contains as much as 14% CO_2 (Table 1).

Platformer feed gas is compressed in a single stage and goes to the raw-gas caustic scrubber together with the overhead gases from the MEA absorber. In the caustic scrubber the CO_2 concentration of the three com-



LOW-TEMPERATURE SEPARATION UNIT separates hydrogen from the feed gas employing an ethylene-nitrogen cascade refrigeration system. Final purification of hydrogen is achieved in a nitrogen wash tower in this unit.

bined feed gases is brought down to less than 1.0 p.p.m. and traces of H_2S are removed.

The gas stream, which is saturated with water vapor after the caustic scrub, is chilled to approximately 55° F. by ammonia refrigeration and most of the water vapor condensed to avoid hydrate formation in subsequent processing. The chilled gases then go through an adsorber to remove oil carryover and are dried to less than 2 p.p.m. moisture by activated alumina. Following passage through a dust filter, the gases are further chilled to 40° F. and enter the LTSU.

2—LOW-TEMPERATURE PROCESSING

The nitrogen scrubbing unit or LTSU makes pure synthesis gas, a separate methane gas stream, a separate stream of ethane plus heavier hydrocarbons, and a CO fraction. The methane fraction goes to the PCI fuel-gas system and the ethane-plus fraction is delivered as a feed gas to the ethylene plant. The CO goes to flare. The LTSU is designed to produce ammonia synthesis gas containing less than 20 p.p.m. of total impurities (CO plus O_2). It is rated at the ammonia equivalent of 310 tons per day.

Pure nitrogen is produced by the air-separation unit from which 90 tons per day of 95% oxygen are also available. At present the oxygen stream is wasted. Provision has been made for later installation of argon recovery facilities.

Both low-temperature units (LTSU and air separation) are designed to operate down to 60% capacity while maintaining the same high product purities specified at full capacity.

Low-Temperature Separation Unit

The feed gases, after purification, enter the nitrogen scrubbing unit at a pressure of 350 psig. and the cooling is accomplished by using an ethylene-nitrogen cascade refrigeration system. Final purification is achieved by liquid nitrogen scrubbing in a nitrogen wash tower. The pure hydrogen-nitrogen product leaves the unit at 340 psig., and after addition of nitrogen at the warm end to make up the correct stoichiometric ratio, it is sent to the synthesis gas compressors. As noted, two other streams are also produced: one rich in methane, and another containing all C_2's and heavier, both at a pressure slightly above atmospheric. The unit is designed so that one-half of the exchanger system can be defrosted while the other half is operating at full capacity; thus materially reducing the down time.

Air Separation Plant

The air-separation plant is a medium-pressure type wherein the feed air stream is compressed to 130 psig. and the products—high-purity nitrogen and oxygen—leave the unit at slightly above atmospheric pressure. Principal features of this type of unit are its ability to produce very high-purity nitrogen simultaneously with high-purity oxygen and with a high over-all recovery, nitrogen recovery being 97%. Refrigeration is produced by Stratos high speed turbo-expanders. A film-type main vaporizer is incorporated in the unit with oxygen circulation by centrifugal pumps. This increases the safety of operation which, together with the adsorptive filters (Sovabead filters used on air feed to high-pressure tower and in O_2-rich liquid air stream from high-pressure to low-pressure tower), are very important factors when operating an air plant in a refinery area where contaminants are likely to be present.

3—AMMONIA SYNTHESIS

Hydrogen mixed with nitrogen, both of commercial purity, is made by the LTSU. Sufficient nitrogen is then added to this mixture to make up the molal proportions of 25% nitrogen and 75% hydrogen. This synthesis-gas feed now enters the synthesis-gas compressors and its pressure is raised to approximately 7,500 psig. The ammonia-synthesis section is designed to operate at a maximum pressure of 9,250 psig. and a temperature of 900° F.

TABLE 1—QUALITY AND QUANTITY DATA—PCI AMMONIA PLANT
(design basis)

Feed gas	M.M.s.c.f.d.	per cent					p.p.m.	
		H_2	N_2	CO_2	CO	C_1+	C_2H_2	H_2S
Tail gas from:								
Hydroformer: (max. avail.)	23.3	64.5	2.4	0.1	0.1	32.9	...	10
Platformer: (max. avail.)	5.5	90.4	0.2	10 (p.p.m.)	0.1	9.3	...	500
Butadiene Pt.: (trimming)	2.1	74.6	...	13.9	...	11.5	200	...
To LTSU	30.6	70.3	2.7	...	0.1	26.9	...	...
From LTSU	25.9	80.8	19.2	...	...	...	Traces	
Blending N_2	2.0	...	100.0	...	...	...	Traces	
Syn Gas	27.9	75.0	25.0	...	...	...	...	...

The synthesis-gas feed is cooled following compression and enters the Casale ejector. This functions to circulate the recycle gas (mixture of nitrogen and hydrogen not converted in Casale converter). The mixture of fresh synthesis gas and recycle enters the converter where the exothermic reaction takes place to make ammonia. Ammonia vapor is condensed (water-cooling) and, with the unconverted nitrogen and hydrogen, enters the high-pressure separator. Liquid anhydrous ammonia flows under level control to the low-pressure separator while recycle gas flows to the ejector.

Any absorbed synthesis gas is flashed off in the low-pressure separator and is returned to an intermediate stage in the synthesis gas compressor. Liquid ammonia from the low-pressure separator flows under level control to the letdown drum, being chilled by ammonia refrigeration en route. A small amount of ammonia is flashed off in the letdown drum in order to vent accumulated gases (impurities) built up in the synthesis loop. A compact, low-temperature (minus 85° F.) ethylene refrigeration system is used to liquefy ammonia and thus separate it from vent gases. This recovered ammonia joins the main stream of anhydrous ammonia and the total ammonia make is refrigerated and flows under level control to storage at 34° F. and 50 psig.

4—INFRARED ANALYZERS

Analyzers used in the ammonia plant, and their functions, include the following:

1. Monitor acetylene background in butadiene feed gas. Calibration range of this instrument is 0 to 400 p.p.m. The sample is taken from a point in the feed gas line and no special sampling equipment is used, with the exception of a dust filter and condensate trap.

2. Measure saturated and unsaturated hydrocarbons in air intake to air-separation plant. Two identical instruments are used, but one is calibrated for 0 to 70 p.p.m. saturated hydrocarbons and the other for 0 to 70 p.p.m. unsaturated hydrocarbons. The sampling system is set up in such a way that samples can be taken either before or after the prefilters on the air intake to the air-separation plant. The only sampling equipment involved is a dust filter and pressure regulator set up for a constant output of 100 psig.

3. Measure acetylene and ethylene in oxygen in air-separation plant. Two instruments are used, both for measurements from two liquid oxygen pools. The main sample point is taken from the O_2 separator with an alternate available from the main vaporizer. One analyzer is calibrated for the range 0 to 2 p.p.m. acetylene in oxygen. The other, calibrated for 0 to 20 p.p.m. ethylene in oxygen, is a special version of a standard model IR analyzer. Both these analyzers are used in series with a liquid-oxygen sample vaporizer for taking the pure liquid sample and supplying it in the vapor state.

Sample vaporization . . . There are several special features involved in the sampling system in connection with the measurements noted under (3) above. This is due to the fact that pure liquid must be secured at the sample vaporizer and a controlled output pressure maintained at 1,000 psig. from the vaporizer assembly.

The sample line after it leaves the cold box is completely concentrically traced to insure pure liquid and to avoid any heat flow from the outside air into the sample line and avoid formation of vapor pockets. After the vaporization cycle, dual pressure regulation is used and the sample is passed through the analyzer, being held under a constant pressure of 1,000 psi. Just prior to entrance to the acetylene analyzer, the sample is split into two parts, one flowing through a drier and into the sample cell, and the other passing through a molecular sieve tower utilizing Linde 3-A sieve material. This sieve material will remove any acetylene but will pass all other hydrocarbons unchanged.

In this manner, we are actually measuring a difference in absorption between the sample containing any acetylene present and the acetylene free sample. Also, we are not sensitive in any degree to other hydrocarbons in the background. This is necessary due to the very low range of calibration and the very low allowable limit of acetylene (which is 0.2 p.p.m.). Incidentally, the allowable limit before pumping, on the ethylene analyzer, is 20 p.p.m. and the shutdown limits on the air intake stream is 10 p.p.m. saturated hydrocarbons and 10 p.p.m. unsaturated hydrocarbons.

Performance . . . Service with the above analyzers in the PCI ammonia plant has shown that they follow conditions in the air plant with good reliability. Instrument engineers and technicians at PCI check these analyzers (and those used in the ethylene and ethylene oxide plants) to insure performance and reliability.

5—COMPRESSION

The compressor building houses six multiple-service compressors, driven by synchronous motors of 3,000, 3,500, and 4,000-hp. ratings.

Total compressor power amounts to 21,000 hp. There are two compressors of each type performing the following functions:

1. Two compressors handle air to the air-separation plant, low-pressure and high-pressure nitrogen, refrigeration ammonia, and refrigeration ethylene.

2. Two compress each of the feed gases separately, the methane-rich fraction from the LTSU and the ethane-plus fraction from the LTSU —a total of five services.

3. Two compress the synthesis gas for delivery to the ammonia converter.

Acknowledgment

Appreciation is expressed to Dr. J. T. Hugill of L'Aire Liquide (Montreal) for information on the air separation and LTSU; to T. E. Reitz (Pittsburgh) and Earl Finear (Denham Springs, La.) of Mine Safety Appliances for information on the infrared analyzers; and to Foster Wheeler Corp. for other information on the ammonia plant.

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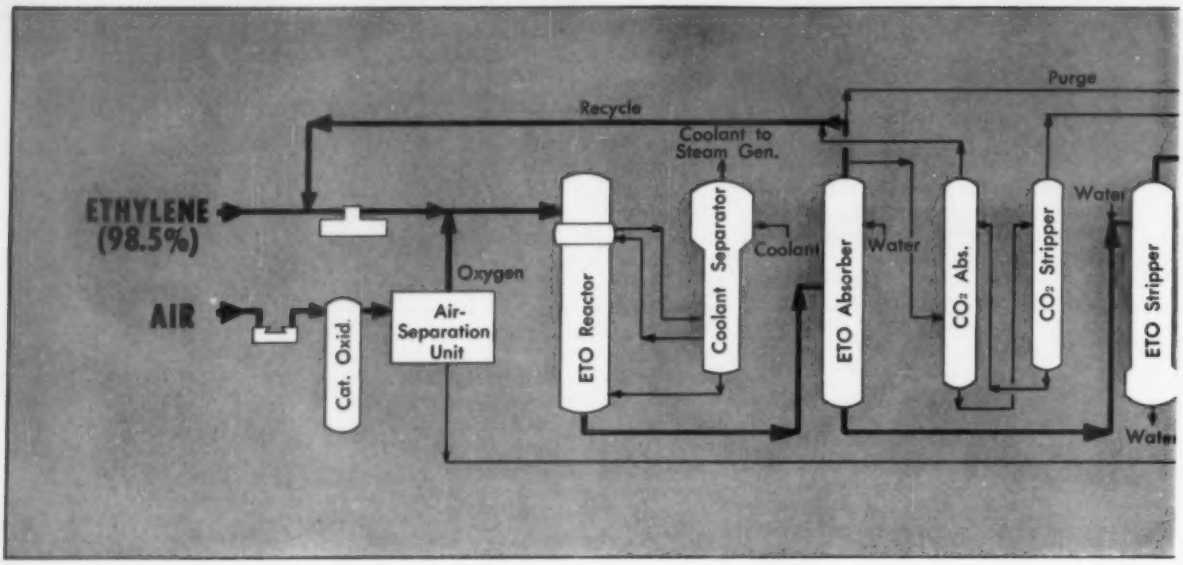


Ethylene oxide plant incorporates Catalytic oxidation unit,

All-electronic control system with special loops and data logging insure close control in making ethylene oxide.

FIRST SHIPMENT of ethylene glycol was made from Calcasieu Chemical Corp.'s new ethylene oxide - glycol plant in September 1958. The glycol was shipped from Lake Charles by barge along the intracoastal waterway and up the Mississippi River system to Mineral Industries, Inc., in Chicago.

The ethylene oxide plant, at design rate, uses as feed stock some 64,500,000 lb. per year of the low-purity (98.5%) ethylene from the PCI ethylene plant. The process used is that of Shell Development Co. which carries out direct catalytic oxidation of ethylene with oxygen in fixed-bed reactors. The CCC plant consumes about 115,000,000 lb. per year of oxygen at 95% or better purity. The ethylene glycol is made by thermal hydration of ethylene oxide.

Capacity of this plant is 8,000,000 gal. per year of ethylene glycol. The intermediate product, ethylene oxide, can be produced up to 57,000,000 lb. per year, or the plant can make ethylene oxide and the glycol simultaneously in quantities intermediate to those just cited.

Security limits the amount of detail in which the process can be described. (Editor's note: For more on ethylene oxide by direct oxidation see article by Sherwood.[1,2]) However, some features incorporated in this plant can be mentioned:

1. A catalytic oxidation unit removes hydrocarbons from the air entering the air-separation unit, a very important measure insuring safe operation of this unit.

2. The instrument system is all electronic and employs some special loops to obtain close control of ethylene oxide processing steps. Instruments are mounted in a carefully designed, full graphic panel.

3. A data logger-scanner system is used, capable of scanning some 100 temperatures each 30 seconds with alarm sounded when preset limits are exceeded.

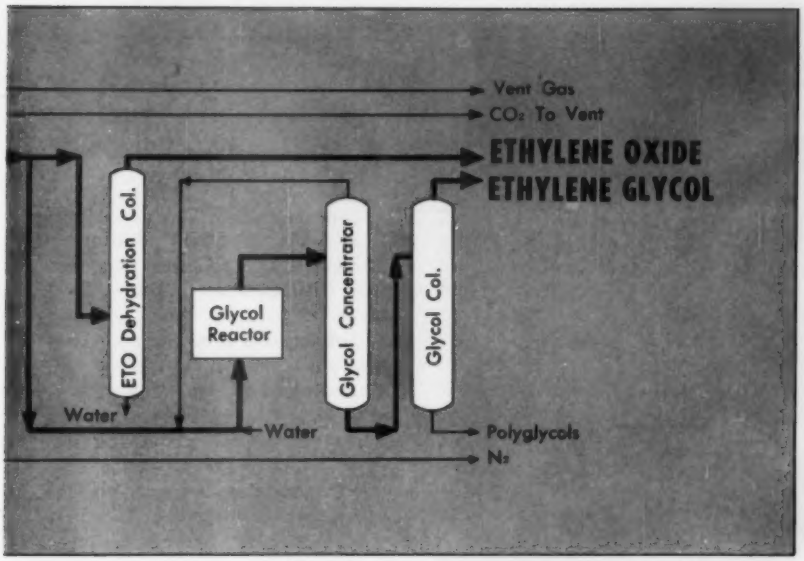
4. Stream analyzers are used: (a) in the air-separation plant to measure total hydrocarbons in air intake, acetylene in oxygen pool, and O_2 in stream leaving the high-pressure oxygen unit; and (b) in the ethylene oxide process section to measure ethylene and O_2 in feed gas, oxygen in recycle loop, and other streams, with provisions for automatic shutdown when safe limits are exceeded.

1.—AIR-SEPARATION PLANT

The oxygen plant of Calcasieu Chemical Corp. is designed to produce 180 tons per day of 95% oxygen at a pressure of 225 psig. for direct use in oxidation of ethylene to ethylene oxide.

This unit is of different design than the air-separation unit in the PCI ammonia plant. The ammonia plant unit is essentially a "gaseous plant." The ethylene oxide air-separation unit is a "liquid plant." The liquid oxygen is pumped up to desired pressure and heat exchanged as a liquid, vaporizing as it undergoes such exchange. It is essentially a low-pressure regenerator type where the air feed is compressed to 75 psig. and a portion of this air is further boosted to a higher pressure. The design departs from the conventional in that the oxygen is produced directly from the unit at its required pressure using special pumps to handle liquid oxygen. Two such pumps are installed—one in operation, the other on standby. With this special cycle the problems of oxygen compressors are eliminated, resulting in a safer operating plant with a lower power consumption and good process control. One of the main features of the unit is its extremely good stability.

Aside from the normal safety measures built into the design (namely film-type vaporizer and rich-liquid filters) a catalytic oxidation unit is used on the main air stream. This unit, the second of its type to be installed in air-separation plants, removes all traces of acetylene and some unsaturated hydrocarbons contained in the air feed, effectively removing impurities at the source before they enter the air-separation unit. The catalytic oxidation unit makes it possible to



NEWEST PETROCHEMICAL COMPLEX

DIRECT OXIDATION—For production of ethylene oxide the Calcasieu Chemical plant at Lake Charles employs the Shell Development Co. process for direct oxidation of ethylene with oxygen. Security limits the amount of information which can be given on this process. Ethylene glycol is made by hydrolysis of the ethylene oxide.

BY C. G. KEVIL
Operating Supt., Ethylene and Ethylene Oxide
and
R. H. LYLES
Process Supt., Ethylene Oxide
Petroleum Chemicals, Inc.

stream analyzers for safety

eliminate use of special, remotely located, air-intake stacks.

2.—ETHYLENE OXIDE PROCESSING

Ethylene and oxygen are combined under controlled conditions to reactors. The reactor effluent gases, containing the ethylene oxide formed in the reaction, pass out of the reactors to the ethylene oxide absorber. The absorber offgas goes through a hot carbonate scrubbing system to remove CO_2 and is recycled to reactors. The ethylene oxide separated by absorption is stripped out and purified to yield a 99.9% ethylene oxide which is shipped as the oxide or hydrated at high pressure and temperature to ethylene glycol. The glycol is fractionated to meet specifications for antifreeze or industrial grade ethylene glycol.

3.—ALL ELECTRONIC INSTRUMENTATION

In the reaction between ethylene and oxygen, the ultimate yield of ethylene oxide as related to throughput and other factors is dependent on close control of temperatures in the reactor.

Why electronic? . . . Accordingly, a reliable electronic control system was installed, keeping in mind advantages such as faster response, possible tighter control, increased stability in certain applications, smooth manual-to-automatic switching, and easy tie-in (compatibility) with automatic data-handling equipment.

The logger-scanner equipment was installed to aid operators in obtaining the requisite close control of reactor conditions and record other plant temperature information. This system measures and prints out all temperatures in 6 minutes. It monitors some 345 points.

The particular electronic control system selected for the ethylene oxide-glycol plant is the same as that employed in the PCI ethylene plant and has been described elsewhere.[6 7 8] It is designed to use direct current (1.5 ma.) signals with electro-mechanical balance (displacement-type transmitter). Use of d.c. signals makes it easy to handle in cascade and ratio-control applications. Special loops were created for such applications in the ethylene oxide plant. A total of 75 loops is used in the ethylene oxide control system and about double that number in the glycol system.

Panel board . . . Field wiring of transmitters and valve positioners from control rooms is in explosionproof conduit terminating in ducts at top rear of panels. Wiring from ducts to panel instruments is by flexible rubber-covered cables with spade lug ends. The

ETHYLENE OXIDE PLANT—Absorption section is on left and dehydrating equipment on right.

ALL-ELECTRONIC CONTROL—Special loops are employed in cascade and ratio-control in the ethylene oxide plant. A logger-scanner system is also used to scan temperature with abnormal printout and alarm.

ethylene oxide control panel is made up of standard modular sections with a phenolic impregnated cover (¼-in. sheet) so that no further finishing is required. This plastic cover greatly simplifies the work involved in making changes on the panel board if and when required. Existing strips and symbols are removed easily with solvent and new ones put on.

Logger-scanner . . . Essential function of the data-handling system[9] is to scan continuously the reactor catalyst, and effluent temperatures on reactors. When a temperature being scanned exceeds preset limits, an alarm is initiated and the abnormal point is printed out on a log sheet. In addition, periodic printout is made of all temperatures being scanned. Thus a quick, accurate log of all scanned points is provided and added protection of the process is obtained by automatically comparing input values against preset limits.

4.—STREAM ANALYZERS

In the ethylene oxide plant **air-separation section** the air intake is located close by. All the air goes through the catalytic oxidation unit. This operates at compressor discharge temperature and converts acetylene, ethylene, etc., to CO_2. Analyzers used in the air-separation section are:

1. A total hydrocarbons analyzer (IR). This measures total hydrocarbons (0-200 p.p.m. CO_2 span) in air samples taken before and after the catalytic oxidation unit. The hydrocarbons are oxidized to CO_2; the analyzer is accordingly sensitized to CO_2 only, with suitable compensation for varying CO_2 level in the intake air.

2. An acetylene analyzer (IR). This is a local recorder with remote alarm. It is calibrated for a dual range of 0 to 2 p.p.m. and 0 to 20 p.p.m. acetylene in oxygen. The low range measurement is taken on a liquid oxygen sample in main vaporizer and the higher range is on air intake. The vaporizer supplied with the liquid O_2 sampling system is identical to that used in the PCI ammonia plant.

3. An oxygen analyzer. This is local recorder with remote alarm. It is used to monitor oxygen purity in stream leaving the high-pressure oxygen unit.

In the **ethylene oxide processing itself,** precautions must be taken with regard to operating outside the explosive ranges for ethylene and oxygen. The analyzers employed here are:

1. An oxygen analyzer on feed to each reactor. This controller resets the flow controller on oxygen to reactor. In case of high O_2 concentration, alarm sounds and oxygen to unit is shut off.

2. An ethylene analyzer (IR) on feed to each reactor. This samples the same point as the oxygen analyzer above and is calibrated for ethylene in the combined feed gas.

3. An oxygen analyzer is used on feed to reactor and on reactor outlet. Other analyzers are also employed here. The control system is tied in with the scanner-annunciator system to sound an alarm.

4. An analyzer on the stream off top of ethylene oxide absorber (IR). This is used as controller resetting the instrument which regulates amount of recycle gas vented.

Special Equipment Notes (Ethylene Oxide Plant)

1. Instrumentation: Manning, Maxwell & Moore "Microsen" electronic.

2. Data Logger - Scanner System: Hagan Chemicals & Controls "Kybernetes."

3. Instrument Panel: Swanson Engineering Co.

4. Analyzers:

In air-separation unit:

(a) Total hydrocarbons-air intake—MSA infrared.

(b) Acetylene in oxygen pool—MSA infrared.

(c) Monitor oxygen purity—Beckman.

In ethylene oxide processing:

(a) Oxygen in reactor feed—Hays paramagnetic

(b) Ethylene in reactor feed—MSA infrared.

(c) CO_2 in recycle gas—MSA infrared.

5. Air - Separation Plant: L'Air Liquide.

6. Catalytic Oxidation Unit: MSA.

7. Compressors:

(a) Ingersoll-Rand centrifugal (handles air to the air-separation unit), 3,500-hp., seven-stage, with water-cooled diaphragms, handles 19,820 cu. ft. per minute from atmospheric to 73 psig. Part of discharge air from this centrifugal compressor goes to an Ingersoll-Rand reciprocating compressor which boosts pressure to 2,700 psig.

(b) Ingersoll-Rand single-stage high-pressure recycle gas compressor driven by 3,000-hp. motor.

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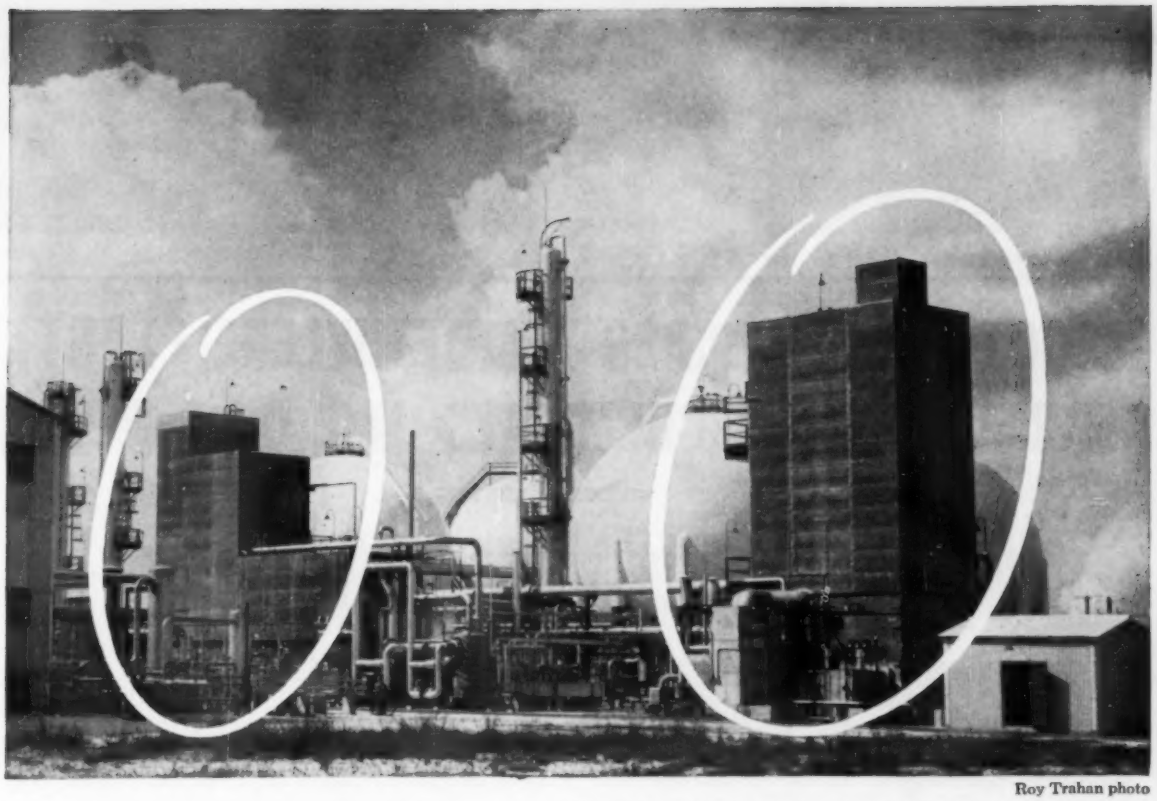

Roy Trahan photo

Part of the Petroleum Chemicals Inc. installation at Lake Charles, La., showing the two Air Liquide units mentioned below.

Low-temperature separation at its best!

The large and complex project of Petroleum Chemicals Inc. and Calcasieu Chemical Inc., at Lake Charles, La., is typical of the wide scope and adaptability of low-temperature gas separation.

At the P.C. ammonia producing plant, a raw hydrogen feed stream containing platformer, butadiene, hydroformer and ethylene cracking off gases, is treated by an Air Liquide low-temperature nitrogen scrubbing unit. It is the largest of its kind to handle such a variety of feed streams.

The resulting ammonia synthesis gas, in correct hydrogen-nitrogen ratio and containing less than 20 ppm of total impurities (CO + Oxygen), is rated at the ammonia equivalent of 310 tons per day.

Pure nitrogen for the ammonia and for the liquid nitrogen scrubbing is produced in an Air Liquide air separation plant rated at 100 tons of oxygen per day. Both units will maintain the same product purities even at 60% capacity.

The Calcasieu Chemical plant, with an Air Liquide 180-ton-per-day oxygen unit, uses the gas directly to manufacture ethylene oxide. This unit, differing from the conventional design, is a low-pressure regenerator type producing at the required pressure of 225 psig using liquid oxygen pumps. This special Air Liquide cycle eliminates the problems of oxygen compressors and results in a safe plant with lower power consumption and good process control.

Behind these achievements is more than half a century of design and engineering experience which can help you solve your own low-temperature problems.

Thousands of Air Liquide plants of every type are in use throughout world industry. Here are some of them.

- Air separation—oxygen, nitrogen, and rare gases.
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- Refinery gas separation.
- Methane purification.
- Natural gas liquefaction.
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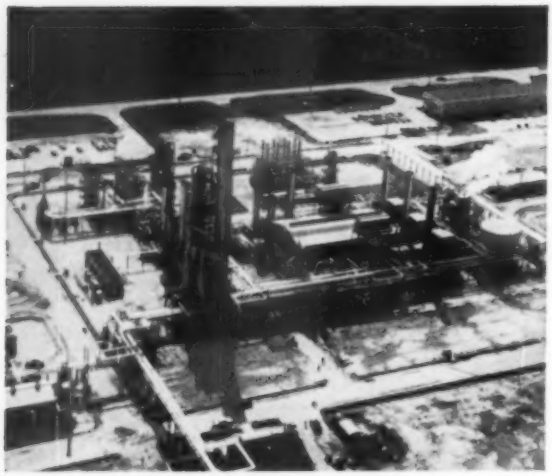


Petroleum Chemicals, Inc. new ethylene plant at Lake Charles, Louisiana is now on stream. Initial ethylene product capacity is 600,000 lbs/per day but Lummus has designed the plant for rapid expansion to a rate of 900,000 lbs/per day. Ethylene will be produced in two grades – the highest grade is 99.7% assay and the other grade 98%. Co-products will be high assay propylene, a butane-butylene fraction and aromatic distillate. Operations have been marked by continuous production of specification high assay ethylene under widely varying rates and feed stock compositions.

The plant incorporates a new ethylene separation process developed by The Lummus Company which provides high separation efficiencies and unusual flexibility and reliability. Feed gases for the ethylene plant are provided from three sources; the nearby refineries of Cities Service and Continental Oil – by whom P.C.I. is jointly owned – and P.C.I.'s new ammonia plant. P.C.I.'s high assay ethylene is delivered via pipeline to customers at Orange, Texas. Part of the new plant's output feeds the adjacent Calcasieu Chemical Corporation's new ethylene oxide and glycol plant, also engineered and constructed by Lummus.

Ethylene is used in the manufacture of polyethylene plastics, anti-freezes, synthetic rubber products, tetraethyl lead and liquid detergents.

Cracking section of the plant features an improved Lummus heater which embodies years of research and development by Lummus' Oil Heater Division.

All major compressors in the Lummus designed low temperature fractionation unit are driven by three 12,500 HP gas turbines. Gas turbine exhaust serves as preheated air for three high pressure steam generators. High efficiency expanders provide low temperatures for maximum ethylene recovery.

This plant brings the total of Lummus designed ethylene plants to 14, with a combined capacity of over 1 billion pounds per year.

Lummus has designed, engineered and constructed over 800 plants for the process industries throughout the world in the last 50 years. Why not discuss your next project with a Lummus representative.

Visit The Lummus Exhibit,
Fifth World Petroleum Congress Exposition,
New York Coliseum, June 1–5, 1959

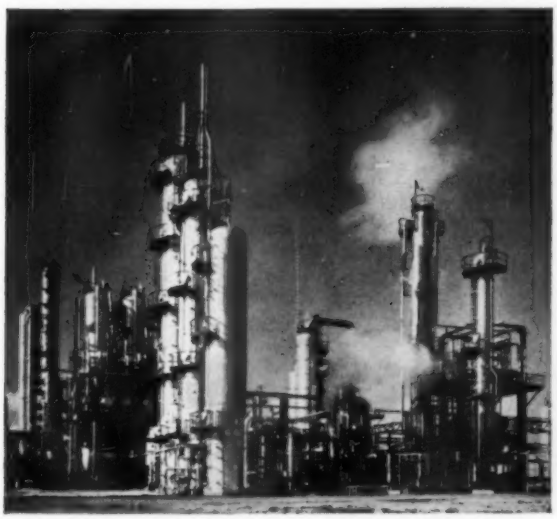
New York 17, N. Y.

ETHYLENE OXIDE-GLYCOL PLANT ON STREAM FOR CALCASIEU CHEMICAL CORPORATION

Lummus Designs and Engineers Plant to produce 60,000,000 Lbs./Year of Ethylene Oxide or 8,000,000 Gallons/Year of Ethylene Glycol

Calcasieu Chemical Corporation's new ethylene oxide-glycol plant at Lake Charles, Louisiana is on stream and producing 8,000,000 gallons annually of ethylene glycol, used principally as a permanent anti-freeze, or 60,000,000 lbs/year of ethylene oxide.

Designed and engineered by The Lummus Company, the plant utilizes the Shell Development Company process. The facility is staffed and operated by employees of Petroleum Chemicals, Inc. P.C.I. will also supply ethylene raw material to the new plant from an adjacent ethylene unit which was also designed, engineered and constructed by The Lummus Company.



The Shell Process, which offers the advantages of unusually high yields and virtual elimination of the waste disposal problems encountered in the Chlorohydrin Process, is conducted in two steps. The first step is direct catalytic oxidation of ethylene with oxygen in fixed bed reactors. Here ethylene oxide, valuable petrochemical intermediate, is produced for use by manufacturers of detergents and other surface active agents, plasticizers, solvents, textiles, drugs and many other petrochemical compounds.

The second step of the Shell Process calls for thermal hydration of ethylene oxide to ethylene glycol, essential to manufacturers of anti-freeze, explosives, plasticizers, fibers, resins, hydraulic fluids and many more chemical products.

This is the third ethylene oxide unit engineered and constructed by Lummus, based upon the Shell Process. For ethylene oxide and ethylene glycol, or for any type of chemical or petrochemical plant, Lummus' half century of world-wide experience on more than 800 plants for the process industries is at your disposal.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y., Houston, Washington, D. C., Montreal, London, Paris, The Hague, Maracaibo. *Engineering Development Center:* Newark, N. J.

New tests show

Which lost-circulation materials to use . . . and how to use them

Part 1 of Two Parts

The author says . . .

1. In lost-circulation materials, size of particles necessary to seal is proportional to the size of the openings to be sealed.
2. In all cases, the seal must take place inside the opening, not on its face.
3. Fifteen pounds of lost-circulation material per barrel of mud is about the optimum.
4. If 15 lb. per bbl. doesn't seal, use a larger particle size or a different distribution of particle sizes.
5. A waiting period is vital because it permits solids to accumulate in the bridge through filtration.

BY B. Q. GREEN
Staff Service Engineer,
Magnet Cove Barium Corp., Houston

THIS ARTICLE describes the results of laboratory tests made on materials used to prevent and cure loss of circulation of drilling mud.

Three types of tests were made:

1. On beads to represent coarsely permeable formations.
2. With conventional parallel-side slots.
3. With a new wedge-shaped slot tester.

Circulation may be lost in a well at any time that total pressure against the formation is higher than pressure in the formation and when the formation openings are about three times as large as the largest particles occurring in quantity in the mud.[1] Lost circulation is of two classes: (1) that inherent in the formation, and (2) that caused mechanically by drilling methods.

Formations which can take mud are those which are: (1) coarsely permeable and unconsolidated, (2) vugular and cavernous, and (3) faulted, jointed, and fissured. The last type includes natural or existing fissures as well as man-made or induced fractures.

Coarse permeability . . . Coarsely permeable formations such as sands and pea gravel vary widely in permeability. Some take mud; others do not.

There are different opinions as to the permeability necessary to take mud. Byck and others have proved that mud cannot be forced into sand with a permeability of less than 14 darcies. In a recent study, natural mud was placed against coarse building sand and subjected to 2,400 psi. with only shallow penetration of the mud into sand.

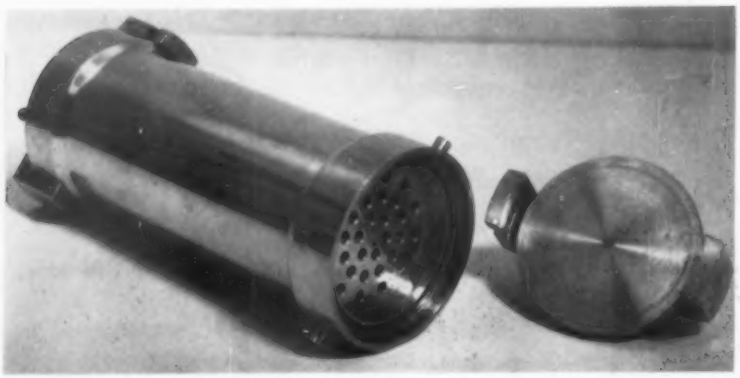
Whether or not a formation will take mud depends on the ratio between the pore openings and the particle sizes found in the mud. It is generally accepted that the formation openings which will permit mud to pass must be about three times larger than the diameter of the maximum particle size found in quantity in mud.[1 2 3]

Many of the solids in ordinary mud have diameters of 70 μ or larger. Such material could be lost only to a formation with 210 μ-diameter openings or larger. This means a permeability of about 325 darcies. However, few formations exceed three or four darcies permeability. Therefore, we may conclude that mud loss occurs only to zones with relatively large openings.

Gravels and similar coarsely permeable loss zones usually lie near the surface and are rare in the subsurface. However, in some areas such as Kansas, North Texas, southern Oklahoma, and the Panhandle area of Oklahoma, they may be deeper.

The Atoka conglomerate in Wise County, Texas, usually lies between 5,000 and 5,800 ft. The granite wash in the Mid-Continent may be at almost any depth. In Nellie field, north of Duncan, it occurs from 2,000 to 2,200 ft.; but in Elk City field, it is found at 12,000 ft.

Caverns, vugs . . . Mud losses to cavernous and vugular formations and sometimes to reefs, gravel, or other permeable zones are usually predict-



BEAD TESTER for the study is this 3-in. cylinder, 8½ in. long. Fig. 1.

Table 1—Series of Tests on 1½-in. Bed at Various Bead Sizes

Material and lb./bbl.—	Surge loss, cc.	Total loss, cc.	Depth of penetration	Cake thickness	Comments
3-mm. Beads					
Shredded leather:					
5	500	500	1½	0	No seal.
10	360	390	1½	0	Heavy surge and 30 cc. dropwise.
15	180	199	1½	0	Less surge 19 cc. dropwise optimum.
20	70	105	1⅜	⅛	Smaller surge. More dropwise.
25	33	88	1⅜	⅛	Smaller surge. More dropwise.
Mica, fine:					
5	500	500	...	...	No seal.
10	300	330	...	...	33 cc. thin cake.
15	175	196	...	...	21 cc. dropwise optimum.
20	110	141	...	...	31 cc. dropwise
25	53	64	...	...	31 cc. dropwise
Cane fiber:					
5	334	371	¼	0	All within beads.
10	115	143	¼	⅛	28 cc. dropwise.
15	55	79	¼	⅛	24 cc. dropwise optimum.
20	20	43	¼	⅛	23 cc. dropwise optimum.
25	0	25	¼	¼	25 cc. dropwise optimum.
Flax shive:					
10	600	600	¼	1	No seal.
20	600	600	¼	1¼	No seal; too coarse.
25	550	550	¼	2	No seal; all on top.
15 Cedar chips	...	...	...	...	Too coarse.
10 Flax shive, 10 mica, fine	175	196	½	1½	Seal, thick cake.
10 Flax shive, 2 shredded leather	275	302	¾	1½	Seal, thick cake.
6-mm. Beads					
Up to 25 lb. shredded leather	...	...	...	...	No seal, too fine.
Up to 25 lb. mica, fine	...	...	...	...	No seal, too fine.
Mica, coarse:					
10	550	550	½	⅛	No seal, incomplete cake.
15	375	400	½	¾	25 cc. dropwise opt.
20	300	320	½	¾	20 cc. dropwise opt.
25	150	180	½	¾	30 about the same.
Cellophane:					
5	...	...	...	...	No seal.
10	550	575	...	...	High surge. Good seal.
15	125	135	¾	1	Good seal-optimum.
20	290	305	½	1½	More dropwise, buildup.
25	350	375	½	1½	More dropwise, buildup.
Cane fiber:					
5	...	...	...	...	No seal.
10	275	350	1	⅛	Good inside seal.
15	90	130	½	⅛	Good inside seal-opt.
20	42	79	½	⅛	Good inside seal. Less loss.
25	18	98	¼	⅜	Seal looser.
Wood fiber:					
5	...	...	...	...	No seal.
10	...	...	...	...	No seal.
15	375	400	½	¾	Good seal-optimum.
20	300	320	½	¾	Good seal, no better.
25	150	180	½	¾	More dropwise, loose.
7½ Cane fiber, 7½ cedar chips	150	225	1½	½	Good seal, small loss.
10 Cane fiber, 10 cedar chips	100	185	1½	¾	Good seal, synergistic value, less loss.
7½ Cane fiber, 7½ wood fiber	300	350	1½	¾	Good seal, fair loss.
10 Cane fiber, 10 wood fiber	250	300	1½	1	Good seal, same dropwise.
10 Flax shive, 10 mica	450	500	1½	¾	Seal, but large loss.
7½ Cane fiber, 7½ flax shive	350	425	1½	¾	Seal, but high loss.
10 Cane fiber, 10 flax shive	325	400	1½	1	Seal, same dropwise.
9.53-mm. Steel Balls					
Up to 25 lb. shredded leather	...	...	...	...	Too fine.
Up to 25 lb. mica, coarse	...	...	...	...	Too fine.
Up to 25 lb. cedar chips	...	...	...	...	Too coarse.
Up to 25 lb. flax shive	...	...	...	...	Too coarse.
Cellophane:					
5	...	...	...	...	No seal.
10	400	425	½	¾	Barely sealed.
15	250	255	1	¾	Good seal optimum.
20	100	115	1	2½	Loose and builds up.
25	15	25	½	3½	Loose and builds up.
Cane fiber:					
5	...	...	...	...	No seal.
10	480	528	1	0	Barely sealed.
15	210	262	⅞	⅛	Good seal, dropwise 50 cc.
20	150	182	1	⅛	Drop about the same.
25	120	153	1½	⅛	Drop about the same.
Wood fiber:					
5	...	...	...	...	No seal.
10	...	...	...	...	No seal.
15	...	...	...	...	No seal.
20	340	375	1¼	½	Seal above 15 lb./bbl.
25	250	320	¾	¾	No better seal.
10 Flax shive, 2 shredded leather	480	499	¾	1½	Good seal, thick cake.
15.2-mm. Marbles—Not Sealed by Any Single Material					
Up to 25 lb. shredded leather	...	...	...	...	Too fine.
Up to 25 lb. mica, coarse	...	...	...	...	Too fine.
Up to 25 lb. cane fiber	...	...	...	...	Too fine.
Up to 25 lb. flax shive	...	...	...	...	Too coarse.
Up to 25 lb. cedar chips	...	...	...	...	Too coarse.
Wood fiber:					
10	550	550	⅛	⅞	No seal.
15	350	406	⅛	⅞	Seal, loose cake.
20	330	353	⅛	1¼	Seal, loose cake, unconsolidated
Flax shive:					
10	550	550	⅛	½	No seal, too coarse.
20	550	550	¼	1¼	No seal, too coarse.
25	550	550	¼	1¾	No seal, too coarse.
Cedar chips:					
15	...	...	...	...	No seal, too coarse.
20	...	...	...	...	No seal, too coarse.
5 Cane fiber, 10 fine mica, 5 cedar chips	190	225	1½	½	Seal good.
10 Cane fiber, 5 wood fiber, 5 fine mica	30	55	¼	½	Seal excellent.
10 Flax shive, 2 shredded leather	450	473	¼	¾	Fair seal, thick cake.

Photos by Robert Yarnall Richie

Designed, engineered and constructed by The Lummus Company, this giant petrochemical complex at Lake Charles, La., has three separate control rooms. The compressor and boiler unit is controlled by 38 Microsen control loops. 141 other loops measure variables to control ethylene processing, and 75 more control the ethylene oxide-glycol unit. Kybernetes data read-out equipment is integrated with Microsen instruments in one of the control rooms.

Over 250 Microsen® loops

automate processes at

Petroleum Chemicals, Inc.

and Calcasieu Chemical Corp.

Microsen Electronic Process Instrumentation measures and controls temperature, pressure, flow, and liquid level in this new $80,000,000 installation. Microsen, the DC control system pioneered by Manning, Maxwell & Moore, Inc., was selected for quality of control and ease of installation.

Standard Microsen instruments are used in cascading. By adding ratio amplification in the output of master Controllers, special variable cascade units are created.

The process boiler installation is unique in the use of electronic instrumentation to control both air and gas supply. A special bipolar accelerating amplifier provides zero output under stable process conditions for the three-element feed-water boiler controls.

If a process upset occurs, the amplifier increases output in the indicated direction to correct the deviation. Amplifier output then decays to zero. Decay time is continuously adjustable within a range of .05 to 5.0 seconds.

Field wiring from Transmitters and Valve Positioners is carried in explosion-proof conduit which terminates in ducts at the rear of the panels in each control room. Wiring from ducts to panel instruments is covered with flexible rubber.

Microsen Electronic Process Controls assure permanent savings. They instantly transmit accurate measurements over long distances – assure process stability and efficiency. The DC signal (1.0 to 5.0 ma) is compatible with practically all data handling, telemetering and computing systems, and with process stream analyzers being developed. Microsen design flexibility anticipates ever-changing needs in process control.

Be certain of closer process control. Step up product quality and quantity. For new plant, new process or revamped old process, automate with the Microsen Electronic System. Learn how profitable it can be. Write for information or call in one of our sales engineers.

MICROSEN ELECTRONIC CONTROLS

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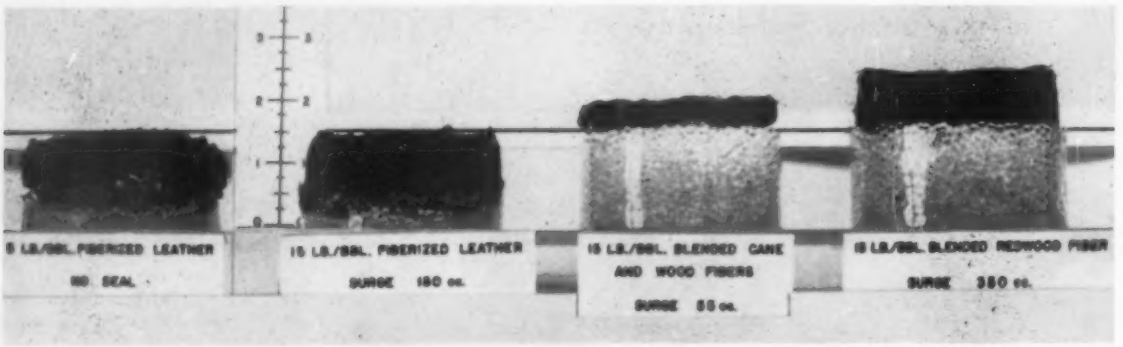
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

BEAD SIZES varied from 3 to 15.2 mm. Bed thickness in all tests was 1½-in. Fig. 2.



VARIOUS MATERIALS sealed the 3-mm. beads. Concentration of 15 lb. per bbl. seemed to be optimum. Fig. 3.

able in a given area because they occur in definite formations which are easily traceable. Vugs and caverns are found in limestone and dolomite. Examples are the "Het" lime in the Gulf Coast area, the Austin chalk in East Texas, and the Caddo lime and Strawn lime in West Texas. The correlation of losses to such formations is quite exact. Where the loss zones in wells have no pattern, mud loss to fissures may be assumed.

Fissures and fractures . . . There may also be mud loss in wells where there are no known coarsely permeable zones or cavernous formations. These losses are to fissures or fractures. Such fissures or fractures may occur naturally; or they may be created, enlarged, or extended by mechanically imposed pressures. In many cases natural fractures exist but under normal conditions they are impermeable. When some critical pressure is reached or exceeded, they open and take mud.

Once a fracture has been created or opened, rapid mud loss will wash out and widen the fracture. Even though the pressure is later reduced, the opening may not close completely, and loss of circulation continues. This is one reason why it is much better to pretreat and prevent lost circulation than to permit it to occur.

The true value of any material is its performance in the field. To evaluate materials in the laboratory, an effort is made to simulate field conditions. Porous formations can be represented by beads of different sizes. Fractures can be represented by parallel slots through brass plugs. Both pore openings and fractures may begin wide, but diminish in size away from the well bore. This condition can be represented by a wedge-shaped slot wider at one end than the other.

Bead test . . . In the past, various size beads have been used to represent increasing permeabilities. Graded sand and gravel beds may also be used, but it is difficult to get exact pore size and permeability.

In this study, a 3-in. cylinder, 8½ in. long, was used to hold the bed of beads. The cylinder had on its bottom a metal plate full of holes. (Fig. 1 shows complete unit and assembly.) Beads varying from 3 to 15.2 mm. in diameter were used to form beds 1½ in. thick on the metal plate (Fig. 2). The holes in the plate must be of such diameter that they may be bridged by the beads used. The pore size increases with the bead size, while the porosity in all cases is approximately 40%.

A 25 to 30-cp. slurry of high-yield clay was used to suspend 5 to 25 lb. per bbl. of each material tested. The unit was filled with the mud containing the selected amount of lost-circulation materials and 100 psi. applied. Results are shown in Table 1.

Bead Test—Summary and Conclusions

The 3-mm. beads were effectively sealed by shredded leather, fine mica, and cane fiber. Other material used failed to seal because they were too coarse. When combined with small amounts of shredded leather or fine mica, wood fiber and flax shive sealed. Fifteen pounds per barrel seemed to be an optimum, and sealing was within the pores. See Fig. 3.

The 6-mm. beads were sealed by coarse mica, cellophane, cane fiber, and wood fiber. Fine mica and shredded leather did not seal because they were too fine. Others did not seal because they were too coarse and formed thick cakes on top of beads. Good seals were formed only within the pores, and about 15 lb. per barrel seemed to be an optimum. When 15 lb. per barrel was ineffective, it was necessary to choose a larger particle-size material.

The 9.53-mm. beads were sealed by cellophane, cane fiber, wood fiber, and combinations of flax shive and shredded leather. With the one exception of wood fiber, 15 lb. per barrel was optimum and all seals took place within the medium.

The 15.2-mm. marbles were not sealed by any single material. However, cedar chips, wood fiber, and flax shive did lodge within the medium. When combined with finer materials to close the finer openings, they did seal. If a seal was made at all, 15 lb. per bbl. was sufficient. Twenty pounds per barrel showed slightly less

surge, but the amount that seeped through dropwise was about the same, so we conclude that the seal is just as good.

In all cases, the particle size necessary is proportional to the size of the openings. In all cases, the seal takes place within the porous medium. In all cases but one, if 15 lb. per bbl. was not sufficient to seal, it was necessary to change the particle size. Whenever coarse material bridges inside the medium but does not seal, a seal may be accomplished by combining with some good fine material capable of completely closing the smaller openings.

Parallel Slot Tester

Another device for evaluating lost-circulation materials is the parallel slot tester. In some cases the setup has a reservoir and a pump; fluid containing the lost-circulation material is moved continuously by or through the slot opening.

In this study the fluid remained static during each test. The parallel slot tester used in this study, Fig. 4, consists of a piece of 3-in. high-pressure tubing long enough to hold 7-bbl. equivalents (2,450 cc.) of mud. The top has a high-pressure gas connection. The bottom piece is fitted with a shoulder to hold the parallel slots.

In these tests, 25 to 30-cp. high-yield clay suspension containing various amounts of lost-circulation material was poured into the cylinder fitted with brass plugs containing various width parallel slots. The width of these slots varied from 0.02 to 0.75 in. When the cell stood full, the top was attacked and slowly subjected to increasing pressure until the seal was blown out, or until it held the pressure decided upon. In this study, the tests were limited to 1,000-psi. differential pressure.

The same materials evaluated in the bead test were evaluated on the slot tester. The width in inches of the largest slot plugged by each material is shown in Table 2.

In most of the parallel slot tests as well as the bead tests, the optimum amount seems to be around 15 lb. per bbl. Results of these tests are shown in graphic form in Fig. 5.

In the parallel slots, all seals or bridging occurs at the entrance to the slot or not at all. Such conditions probably do not exist down the hole. It is felt that seals must take place within the formation.

Shredded leather produces an excellent seal that is very tight and could hold 1,000 lb. across an opening 0.02 in. wide. Fine mica, and several others not shown sealed 0.04 in. in width. Ten to fifteen pounds per barrel was effective if the material itself was effective at any concentration. If this amount did not seal, it was necessary to change the particle size.

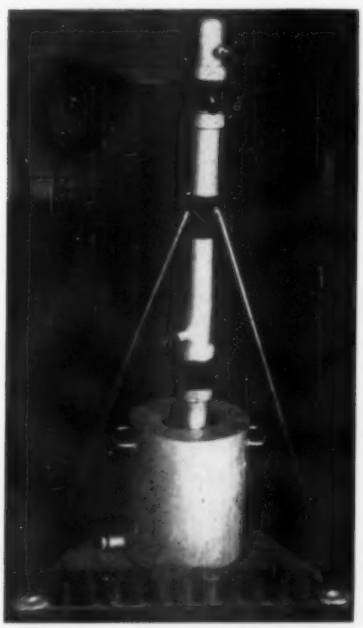
Coarse mica, and wood fiber sealed openings 0.10 in. in width. Flax shive sealed slightly wider openings or 0.12 in.

Regular walnut shells containing a wide particle-size distribution sealed openings 0.22 in. in width, and 5 lb. per bbl. of flax shive combined with the walnut shells increased this slightly to 0.24 in. Up to a maximum of 40 lb. per bbl. would not seal wider openings, but 10 to 15 lb. per bbl. of extra large walnut shells sealed an opening of 0.54-in. width. This material cannot be handled with regular pumping equipment. Coarse formica sealed 0.50-in. slots, but might require several pourings to form a bridge.

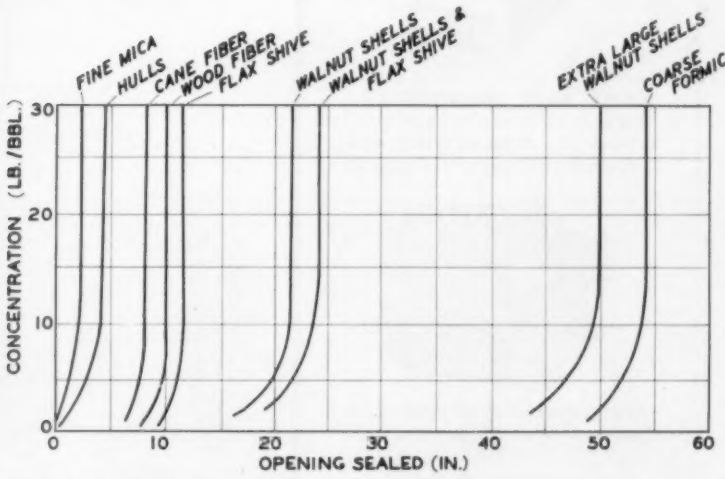
Some materials known to be successful in the field did not show up well on either the bead test or the parallel-slot test. For this reason a new method using a wedge-shaped slot was devised.

TABLE 2—PARALLEL SLOT TEST

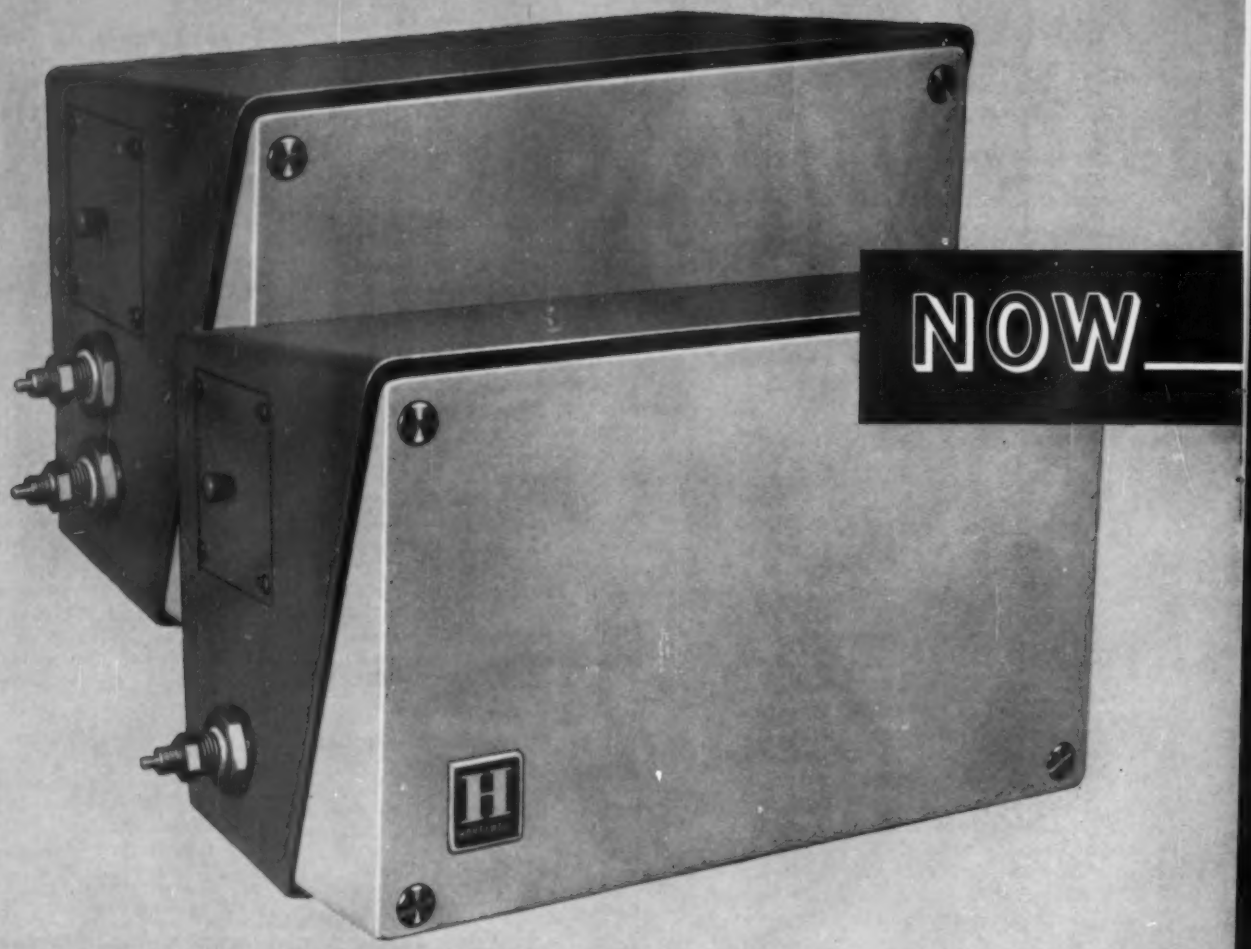
Material—	Lb./bbl. for effective concentration	Size of slot sealed in inches	Comments
1. Shredded leather	10	0.02	Excellent on fine opening.
2. Mica, fine	5	0.04	Good seal on small openings.
3. Mica, coarse	10	0.10	Plugged but seal leaks fluid.
4. Cane fiber	15-20	0.04	Excellent seal.
5. Wood fiber	15	0.10	Not as tight as 4 and too thick above 20 lb./bbl.
6. Flax shive	15	0.12	Not as tight as 4 and too thick above 20 lb./bbl.
7. Walnut shell, coarse	10-15	0.22	More concentration, seals quicker.
8. Coarse formica	15	0.50	Seal; not easily formed.
9. Walnut shells, extra large	10	0.54	Coarse but strong; special pump required.
10. Walnut shells, coarse/flax shive	15/5	0.24	Slightly larger bridge and quicker than walnut shells alone.



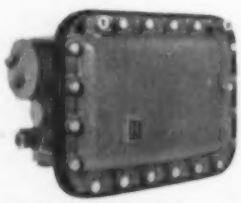
PARALLEL SLOT TESTER consists of a piece of 3-in. high-pressure tubing long enough to hold 2,450 cc. of mud. Fig. 4.



RESULTS OF PARALLEL SLOT TESTS show the size opening which can be sealed by each material. Fig. 5.



RELAY RACK MOUNTING permits four transducers to be mounted abreast on a standard 19-inch-wide relay rack with 7-inch vertical spacing.



EXPLOSION-PROOF HOUSING meets conditions of operation specified under Class I, Group D, Division 1 of the National Electrical Code.

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	P/I TRANSDUCER	I/P TRANSDUCER
Input	3-15 psi	4-20 ma d-c
Output	4-20 ma d-c	3-15 psi
Accuracy	±¼% of span	±¼% of span
Ambient temperature range	-40° to +150°F	-40° to +150°F
Maximum load resistance	800 ohms	————
Supply	42 ±2 V d-c	20 psi
Air Consumption	————	less than 0.35 cfm

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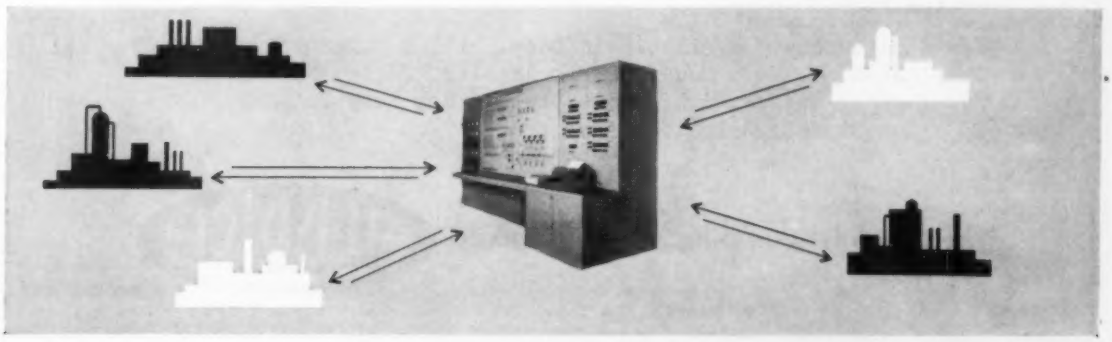
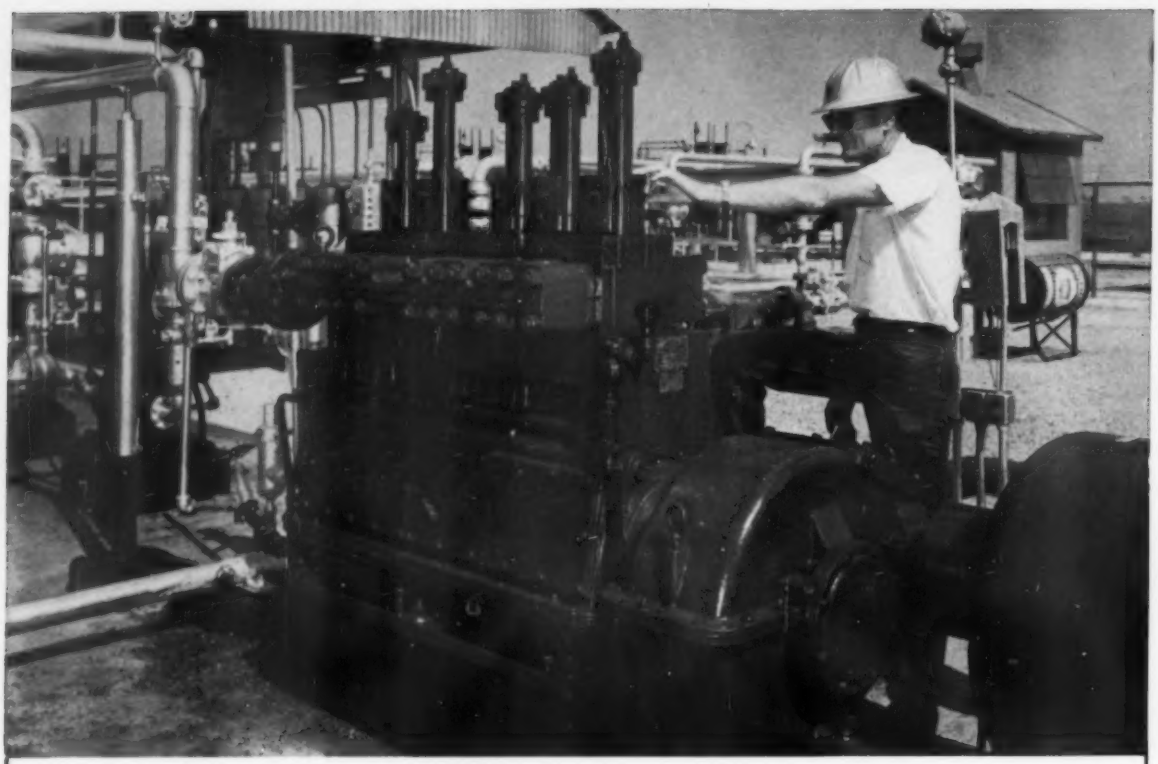
Diagram symbolizes use of transducers in a "wheel-type" plant to convert signals from existing pneumatic instruments to electric signals for data processing or electric control. White silhouettes represent future plants.





FIELD REPORT

SERVICE: LP-Gas Injection

Burnell—North Pettus Cycling Plant

PUMP: 1½"x5" Aldrich Quintuplex

OPERATION STARTED: June, 1950

EXPERIENCE TO DATE:

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Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

6. How to measure absolute permeability

(a) Using linear flow and compressible fluid

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa
and
F. M. STEWART
Staff Engineer, Alex McCoy Associated, Inc.

GIVEN: The following data were obtained during a routine laboratory permeability test:

Run No.	Air flow volume at outlet end, at atm. press., ft.³	Pressure drop across core, in. Hg	Time of flow, sec.
1	0.100	3.90	700
2	0.292	14.96	462
3	0.404	25.64	331
4	0.515	39.91	236

Pressure at outlet end = atmospheric.

Atmospheric pressure = 760 mm. Hg.

Air temperature = 76° F.

Average cross-sectional area of sample = 1.36 sq. cm.

Average length of sample = 1.3 cm.

Viscosity of air at 76° F. = 0.0183 cp.

FIND: Absolute permeability of core.

METHOD OF SOLUTION:

$$Q_m = \frac{A\,k\,(p_1 - p_2)}{\mu\,L} \qquad (1)$$

or

$$Q_a = \frac{A\,k\,(p_1^2 - p_2^2)}{2\,\mu\,p_a\,L} \qquad (2)$$

Where:

Q_m = rate of flow at mean flow conditions of pressure and temperature, cc./sec.

A = core cross-sectional area, sq. cm.

k = absolute permeability, darcies

p_1 = absolute inlet pressure, atm.

p_2 = absolute outlet pressure, atm.

μ = viscosity of flowing fluid at mean conditions, cp.

L = length of core, cm.

p_a = atmospheric pressure

Q_a = rate of flow at atmospheric pressure and flowing temperature, cc./sec.

Solution:

Using Equation 2 and solving for k,

$$k = \frac{2\,\mu\,L\,p_a\,Q_a}{A\,(p_1^2 - p_2^2)} \qquad (3)$$

for run 1

$$k = \frac{(2)\,(0.0183)\,(1.3)\,(1)\,(2{,}831.7)}{(1.36)\,[(1.13)^2 - (1)^2]\,(700)}$$

$$= \frac{134.7}{263.2} = 0.512 \text{ darcies}$$

Where:

p_a = 1 atm.

$$Q_a = \frac{0.1 \text{ ft.}^3 \times 28{,}317 \text{ cc./ft.}^3}{700 \text{ secs.}}$$

$$= 4.05 \text{ cc./sec.}$$

$$p_c = \frac{3.9 \text{ in. Hg}}{29.92 \text{ in. Hg/atm.}} + 1$$

$$= 1.13 \text{ atm.}$$

$$1/p_m = \frac{1}{\frac{1}{2}\,(1 + 1.13)} = 0.94$$

Similarly for Run 2,

k = 0.501 darcies and $1/p_m$ = 0.80

for Run 3,

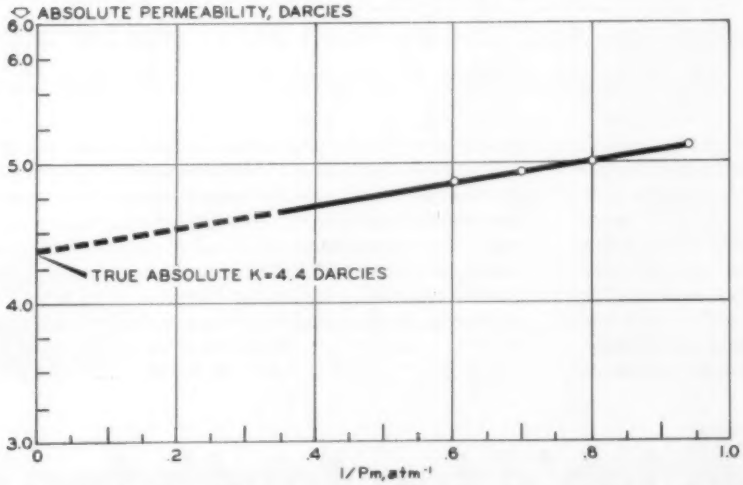
k = 0.494 darcies and $1/p_m$ = 0.70

for Run 4,

k = 0.486 darcies and $1/p_m$ = 0.60

DISCUSSION: The characteristic of a porous medium to allow the flow of a fluid or fluids through it is referred to as permeability. When only one fluid is present and flowing through the medium then the measured permeability is defined as the absolute permeability. This is the type usually measured in routine core analysis. Measurements are normally made at room temperature with a pressure drop of less than 1 atm. The calculation of absolute permeability from laboratory measurements is performed by using either Equations 1 or 2. In both equations the following assumptions are made: (1) Single phase flow, (2) laminar or viscous flow, (3) steady-state flow, (4) velocity of flow is equal to Q/A, and (5) no reaction between flowing fluid and porous medium.

It has been found from experimental tests that gases do not strictly follow a laminar flow in porous media. Actually a slippage effect occurs along the walls of the pores resulting in more flow and a higher value of



IN LABORATORY ANALYSIS, a low mean pressure yields a value higher than the true permeability of the medium. The true absolute permeability can be found by extrapolating the curve back to an infinite mean pressure.

Chevy power is tough—

and proves it on bruising off-the-road hauls!

That Series 100 Chevy tandem above takes a terrific pounding as it hauls huge loads of gravel or fill dirt into the heart of California's redwood country. It goes miles off the road, makes up to 24 trips a day through rocky forest land. Yet owner Bernard Conti, of the Conti Sand & Gravel Company, reports only one hour of downtime in 20,000 miles on this truck-killing road construction job. And Chevy's tough power gets the truck through faster, Mr. Conti says; assures more trips—more profits—per day!

Hauling outsized loads of fill dirt through California's forests calls for a heavy-duty truck that's rock-rugged and powerful as they come; one that's soundly built down to the last bolt. And the Conti Sand & Gravel Company bears witness to the fact that Chevrolet is just such a truck. They're completely satisfied with their Series 100 model, from the dependable pulling power of the big 230-h.p. Workmaster V8 to the work-whipping qualities of the tough-built chassis components. And you'll be equally satisfied with whichever Chevy heavyweight or middleweight *your* work requires!

Mr. Conti indicates that Chevrolet's Powermatic* transmission is of special importance in this rugged service. It helps him to bull through the tough spots with exceptional ease. This fully automatic 6-speed transmission virtually eliminates manual gearshifting! It also provides a Hydraulic Retarder that helps you control truck speed and saves wear on the service brakes.

**Optional at extra cost, Series 50, 60, 70, 80, 90 and 100 models.*

No job's too tough for a

Chevy's powered to cut costs and keep going on your tough off-the-road hauls!

That's for *sure*, whether you use mighty middleweights or high-capacity heavyweights—whether you prefer V8's or 6's.

Take Chevrolet's 1959 big-truck V8's, for example. As indicated by that tough truck job pictured above, these modern engines are out to whip any work that comes their way. They've got what it takes to do it. The *shortest piston stroke* of any comparable truck V8's: a sure sign of more work on less fuel. Compact design that cuts down on truck weight and helps assure the biggest possible payloads. Scores of up-to-the-minute features that know how to trim overhead: full-flow oil filter, hydraulic valve lifters, hard-faced exhaust valves and hardened valve seats, extreme-duty Moraine 400 bearings, rotor-controlled governor, overspeed warning light and many more.

And with a *complete* lineup of modern V8 powerplants —including 160-h.p. Trademaster, 160-h.p. HD Taskmaster, 175-h.p. HD Super Taskmaster, 185-h.p. Workmaster Special and 230-h.p. Workmaster—Chevy can match the engine to your work, ideally.

Or if you prefer 6's, Chevy's *still* your best bet. Standard in Series 40 models is the 135-h.p. Thriftmaster 6, better than ever for '59 with a new Economy-Contoured camshaft that improves gas economy by 10%! And in Series 60 there's a new edition of the 150-h.p. Jobmaster 6. It offers new durability stemming from new tougher built pistons and Stellite-faced exhaust valves. Both of these famous 6's provide plenty of hard-pulling torque.

Six or V8, you'll go a long way before you see the likes of this '59 Chevy engine lineup. Actually, there's only one *best place* to go for all your trucking needs —and that's to your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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permeability than is true. This effect is a maximum at low mean pressures and for porous media having low permeabilities (less than 20 md.). Note in the graph that the lower the mean pressure, the higher the permeability obtained. At very high mean pressures the slippage phenomenon becomes a minimum and thus (using gases) the true permeability is obtained by extrapolating a curve of the ratio of one to the mean pressure versus permeability to infinite mean pressure as illustrated in the graph.

In routine core analysis no correction is made for the slippage phenomenon and thus a permeability higher than the true absolute permeability is reported. For permeabilities of several hundred millidarcies the error may be very small (2-5%) while for lower permeabilities (5 to 50 md.), the error may amount to 50% or more. It can safely be said that in most cases permeability is used with other factors that are equally as inexact and thus routine permeability measurements are sufficiently accurate.

Absolute permeabilities are used widely for correlations with (1) interstitial water saturation at a constant capillary pressure, (2) porosity, and (3) injectivity factors. It is also used with relative permeability to calculate effective permeability. Another wide use of absolute permeabilities is for the construction of permeability logs (permeability profiles) so that the formations of interest may be correlated for different wells in a single field. This type of log serves to positively locate tight streaks or shale breaks that may have been missed by other types of well logs. These logs also are indicative of the type and degree of stratification present, this information being useful in completion work and in the selection of wells for injection.

This information is also helpful in determining net sand thickness when used with oil-saturation data. When used for this purpose, any errors in the measurements (resulting from changes in the core due to handling and processing and from the slippage phenomenon, become critical in the low-permeability ranges. Too, it is well to remember that the in-place rock normally contains two or more fluids.

(b) Using linear flow and noncompressible fluid

GIVEN: A permeability test was performed on a sandstone core using water as the flowing fluid and the following data obtained:

Flow rate = 10 cc. water in 500 seconds.

Test temperature = 70° F.

Pressure—upstream = 1.45 atm. abs.; downstream = 1.0 atm. abs.

Viscosity of water at 70° F. = 0.984 cp.

Cross-sectional area of core = 2.0 sq. cm.

Length of core = 2 cm.

FIND: Absolute permeability of core.

METHOD OF SOLUTION:

$$k = \frac{\mu_w Q_w L}{A (p_1 - p_2)} \qquad (4)$$

Where:

μ_w = viscosity of water at test temperature and mean pressure, cp.

Q_w = rate of water flow, cc./second

Other terms as defined in (a).

Solution:

$$Q = \frac{10}{500 \text{ sec.}} = 0.02 \text{ cc./sec.}$$

$$k = \frac{(0.984)\ (0.02)\ (2)}{(2.0)\ (1.45 - 1.0)}$$

$$= 0.044 \text{ darcies}$$

$$= 44 \text{ md.}$$

DISCUSSION: Equation 4 is the steady-state formula for the flow of a noncompressible fluid through a porous medium. When the fluid fully saturates the medium then the measured permeability is the absolute value. If there is no reaction between the flowing fluid and the medium and if viscous flow prevails, it makes no difference what fluid is used (compressible or noncompressible), the absolute permeability obtained will be the same. This means that absolute permeability is independent of the nature of the fluid and is dependent solely upon the structure of the porous medium.

In routine core analysis water is not used to measure absolute permeability because it is difficult to obtain a water compatible with the sample. Most waters will react with the sample to some degree resulting normally in a lower permeability. Also such a test would take considerably more time to perform and be costlier than one utilizing a gas.

References

1. Muskat, M., Physical Principles of Oil Production, McGraw-Hill Publishing Co., pp. 123-124.

2. "Engineering Fundamentals on Petroleum Reservoirs," manual, The Oil and Gas Journal, pp. 34-35.

BOOKS

SUBSURFACE GEOLOGY IN PETROLEUM EXPLORATION. A symposium edited by John D. Haun and L. W. LeRoy. Published by Colorado School of Mines, Golden, Colo. 888 pp., $10.

This book deals with the tools and techniques used in the search for new oil and gas pools. The volume covers all of the various facets of subsurface exploration such as analysis of well cuttings, cores, and fluids; well logging methods and interpretation; subsurface interpretation; geophysical and geochemical prospecting; drilling, formation testing, and well completion; subsurface reports; exploration planning.

This new book is a logical outgrowth of "Subsurface Geologic Methods", compiled by L. W. LeRoy. However, because of the rapid advancements and refinements in exploration techniques during the past few years, it was necessary to reorganize and compile these methods in this new volume. The book will be of particular value to geologists and petroleum engineers as well as to educational institutions that offer formal courses in subsurface geology and petroleum geology.

CORROSION OF OIL AND GAS-WELL EQUIPMENT. Published by Division of Production, American Petroleum Institute, 309 Corrigan Tower Bldg. Dallas 1. 87 pages. $2.50

This well-organized book covers all aspects of corrosion in and around the oil and gas fields. After the introductory chapter on the general nature of corrosion, the major topics of sweet corrosion, sour corrosion, oxygen corrosion and electrochemical corrosion are covered in detail.

Each chapter is subdivided to include a description of damage, methods of evaluation of extent of the problem, and control measures. The appendix contains a glossary of terms, bibliography, discussion of oil-well pump corrosion, and a survey of methods used in cathodic-protection studies.

Adequately illustrated, the manual is directed at field operating personnel to help them appreciate the corrosion problem and make them aware of its importance in successful operation of oil and gas wells and associated equipment.

THE PROPERTIES OF GASES AND LIQUIDS. By Thomas K. Sherwood and Robert C. Reid. Published by McGraw-Hill Publishing Co., 330 West Forty-second Street, New York 36, New York. 386 pp. $10.

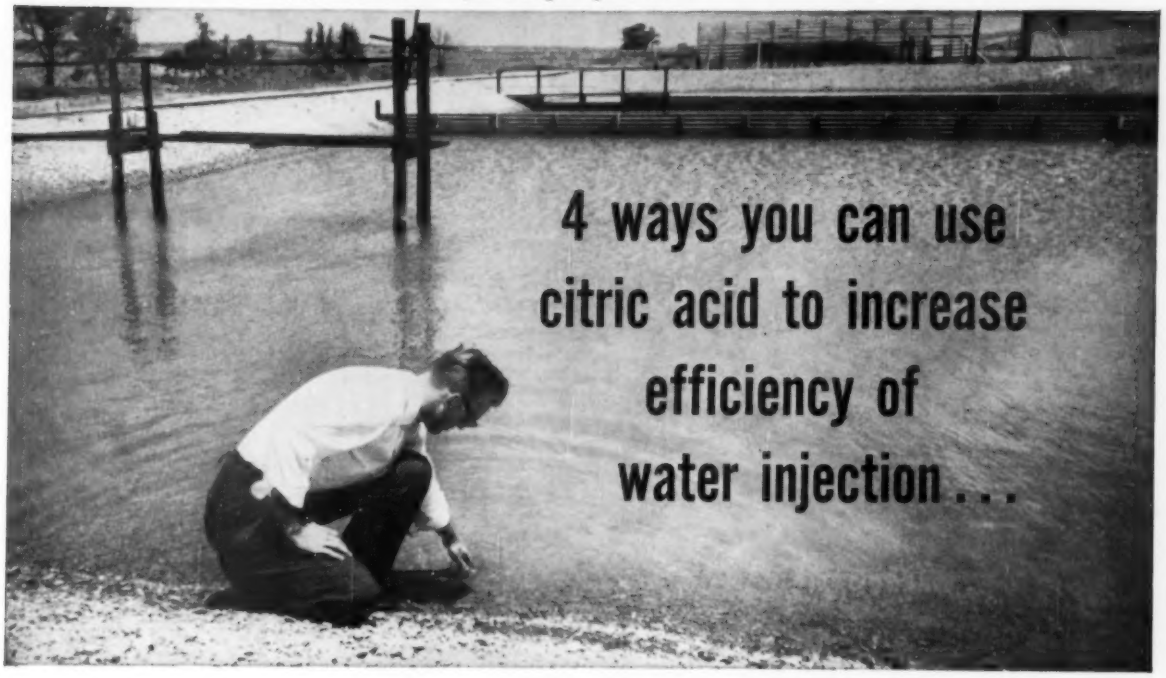
This book presents a critical review of the methods useful in correlating or estimating the more important physical properties of pure materials and simple mixtures.

Each property is first discussed from a theoretical standpoint. Following this, both theoretical and empirical methods of estimating the property for new substances are discussed and compared with data. Methods of extrapolation of experimental data to unexplored ranges of such variables as temperature and pressure are also presented.

The book treats estimation of these properties: critical pressure, critical temperature, critical volume, compressibility, vapor pressure, latent heat of vaporization, heats of formation, free energies, heat capacities, viscosity, thermal conductivity, diffusion coefficients ,and vapor-liquid equilibrium.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

Iron is probably the most serious cause of plugging problems at three out of five water flood projects...



The success of citric acid in increasing water injection efficiency has been proved in four distinct types of applications. Variations in water quality and operating conditions will determine which application you should use. **In each case, citric acid sequesters iron in your injection water, prevents the serious plugging action of iron precipitates.**

1. Maintenance Treatment entails the constant addition of citric acid (3:1 or 4:1 ratios of citric to iron content) to prevent iron from filtering out on the sand into which the water is injected. This, of course, helps to maintain high injection rates at normal pressures. For best results in maintenance treatment with citric acid, a water injection plant should be operating at optimum injection rates and pressures.

Two salt water disposal wells in southern Texas, with average injection rates of 200 to 400 barrels per day showed a 30 percent increase in injection shortly after only 8 ppm addition of citric acid was started as maintenance treatment.

2 & 3. Acidizing and Detergent Treatments are very important adjuncts to successful maintenance treatment. When iron plugging the sandface has already caused lowered rates and/or high pressures, acidizing with citric and hydrochloric acids or cleaning with detergents plus citric acid are excellent methods for returning the injection wells to optimum conditions.

A well in Oklahoma showed marked improvement after acidizing with a solution of 260 pounds citric acid, 25 gallons Triton* X-100, 250 gallons 15% hydrochloric acid and 500 gallons water. The injectivity index rose to 195 bbl./day/ft. of pay from 3 bbl./day/ft. of pay. Gradual decline was noted over a short period, but the index leveled at 80 bbl./day/ft. of pay.

4. Slug Treatment with citric acid is designed for those systems where the water contains iron which cannot be economically treated to keep the iron in solution, or for those systems where the iron is completely precipitated before the water can be treated. Slug treatment at 500 ppm once every 4 to 6 weeks sufficiently lowers the pH to dissolve much of the insoluble iron, and the cost of treatment is low when averaged over this period of time.

A well in southern Louisiana was treated by slugging with two 400-pound batches of citric acid, two weeks apart. Injection rates have more than doubled, from 4,000 to 8,640 barrels per day, at last report, and in addition, the pressure has averaged 300 psi lower than previous requirements.

Other operators have noted good results because of less frequent downtime on filters, and less replacement of parts because of rusting. If water flooding is your business, and you would like complete information on the use of citric acid for iron sequestering, write the Pfizer Chemical Sales Division today.

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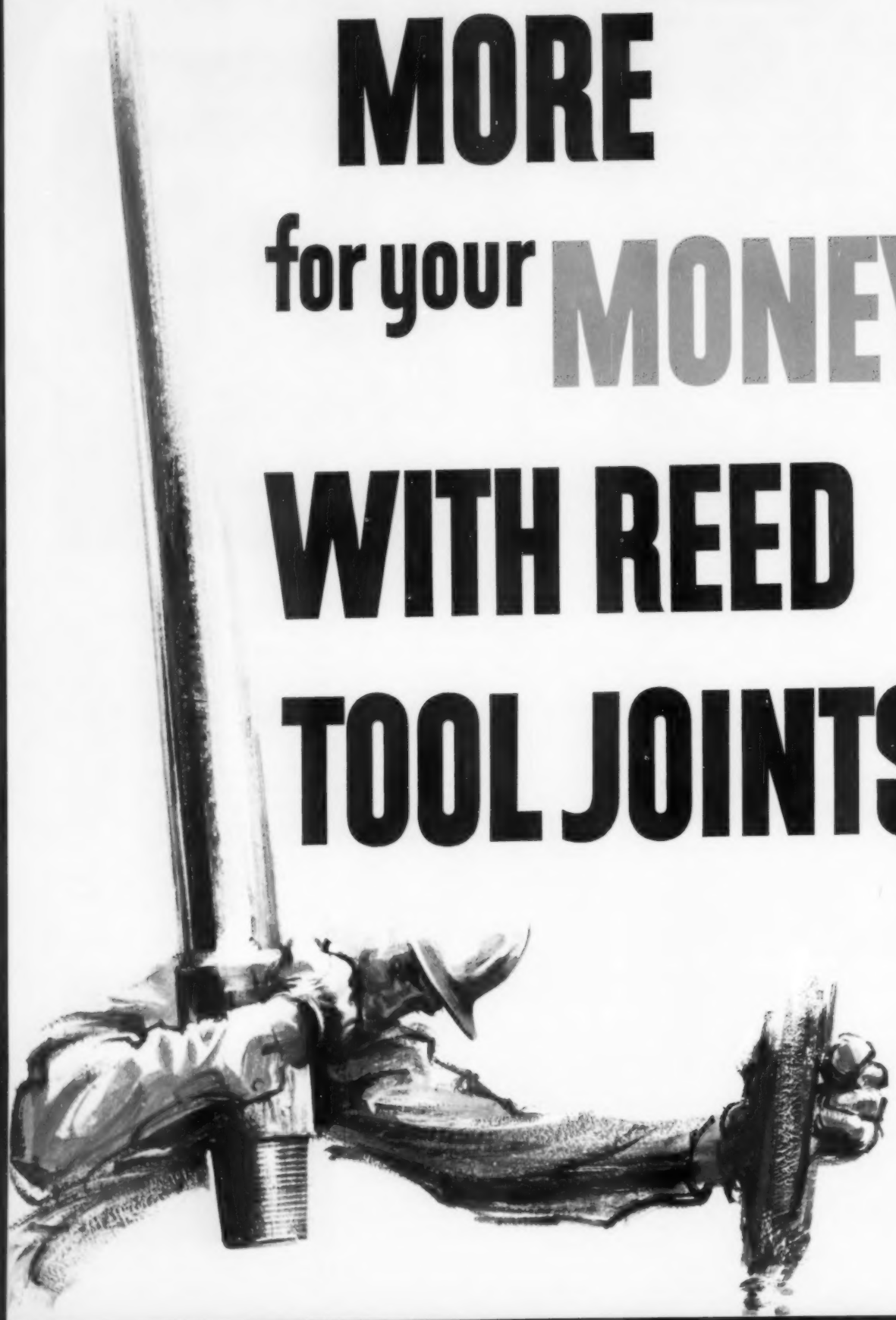

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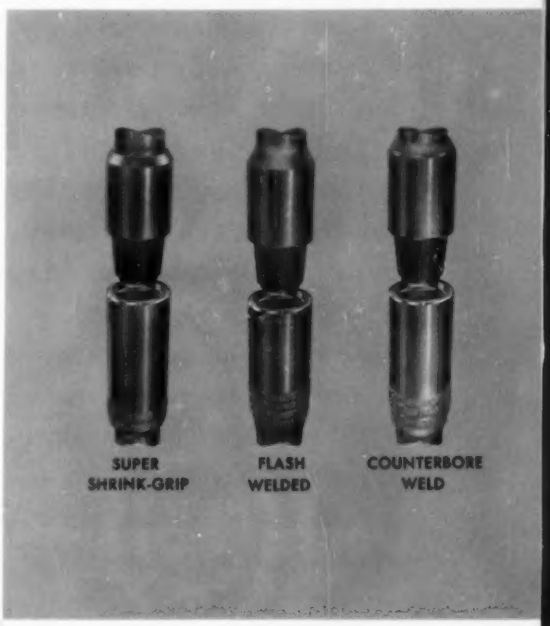

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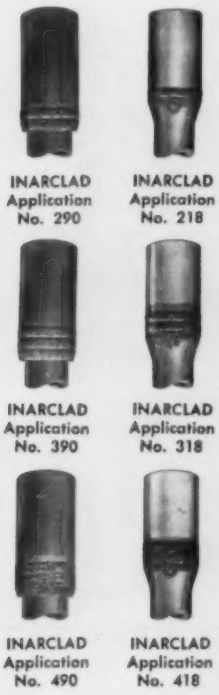
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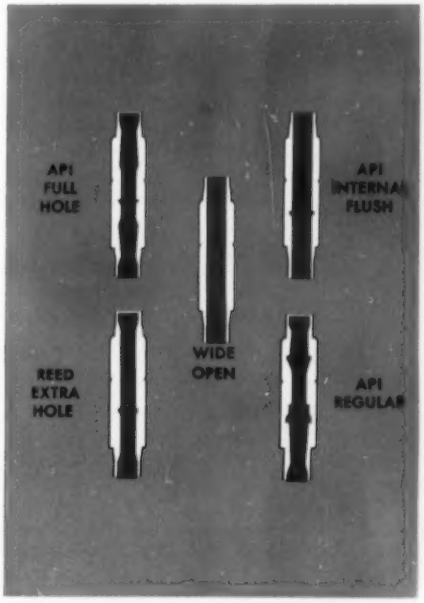

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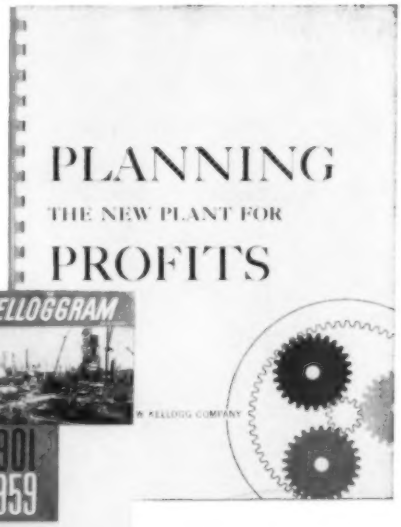

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WPRA REFINING QUIZ—2

Session on

Refinery Maintenance

Questions from the floor—
Answers from the panel—
with audience participation
in the discussion

THE PANEL

W. L. BANKS, Moderator
WPRA Technical Director
Tulsa

GEORGE JANDACEK
D-X Sunray Oil Co.
Tulsa

GEORGE F. KLINE
Blaw-Knox Co.
Pittsburgh

O. J. WEBB
Stratford Engineering Corp.
Kansas City, Mo.

W. L. HOUSTON
Phillips Petroleum Co.
Sweeny, Tex.

E. D. MATTIX
Cities Service Refining Corp.
Lake Charles, La.

WALTER COSINUKE
Catalytic Construction Co.
Philadelphia

E. H. McGREW
National Aluminate Corp.
Chicago

GORDON KERNS
Vickers Petroleum Co.
Potwin, Kans.

W. K. DANIEL
Standard Oil Co. (Ohio)
Cleveland

WILLIAM T. MADDOCK
Ohio Oil Co.
Findlay, Ohio

Here is the second portion of the transcript for a 2-day session at the latest El Dorado, Ark., regional meeting of Western Petroleum Refiners Association. The remaining material will be published in future issues of the Journal.

BANKS: What operating control problems have been associated with the use of air in direct coolant and what control techniques were used to bypass the air shutters, reversible propellants, pitch, etc.?

HOUSTON: The problem of control in air-fin coolers, used in overhead condensers on fractionating towers, is that of varying temperature in the overhead accumulator and, therefore, the variations in temperature in the reflux. Sudden changes in air temperature upset the tower propellers. We've found that they are either expensive, ineffective, or both. We have a control system in operation which is simple and very effective. Before developing this new control system, and its application on a pentane splitter column, we were faced with many control problems.

This 100-tray column was provided with a hot-vapor bypass to control reflux accumulator pressure. Reflux temperature was controlled by shutting down or starting up one of the fans on the condenser section. A cloud passing under the sun would drop the reflux temperature as much as 8° or 10° F. A sudden rain shower would drop reflux temperatures 35° F. These changes would throw the product streams off specifications. In fact, we have found that the pentane bottom product, with these wide variations in temperatures due to the rain and showers, would sometimes contain as much as 25-30% of isopentane, rather than the desired 3-6%.

This new control system has stabilibed the entire operation to the point where the separation in this column is not affected by changes in temperature of 30°-35° F. in 10 minutes. I had hoped to be able to discuss the nature of this system at this meeting, but our patent people are seeking coverage of this system and have asked me not to discuss it. We do hope to be able to offer it to the industry in the near future.

KERNS: We've had a similar problem in the use of air-cooled overhead condensers in the benzene, toluene, xylene, and solvent overhead, in our Udex plant. We did not find a satisfactory approach. We have air shutters and high and low motor-speed control. We experimented with a hot-vapor bypass, but were not successful. We have learned to live with the situation, though. We were running down to atmospheric drums from a fairly low pressure, as a result of subcooling condensate.

We merely expanded our rundown limes, I think we went from 3 to 4 in. or some similar increase and accepted the low pressure gradient that we had, to get into these atmospheric drums. Apart from that, we have had no serious problems. We're satisfied with our temperature-control system and can follow our Kansas clouds, although we probably don't have the clouds that Bill Houston has in Texas. We have been kicked off by sudden rain showers, and have had to put the columns on manual control, but we expect this.

COSINUKE: I've talked to a number of vendors on this subject. It is their consensus that in most installations, operators control temperature by cutting out banks of fin-fans. In most refinery operations they seemed to think that this method was stable enough. The two cases the gentlemen previously presented need for a little more critical control than that required in a normal crude overhead condenser.

The use of air cooler is becoming a trend, an economical trend, and is one that everyone is considering when

designing new units. There are people that are very much against them at first, but they are going to live with them because of economics.

BANKS: What is being done about preheat - exchanger fouling in various refining operations? Also, what's the primary cause of this fouling?

KLINE: Preheat-exchanger fouling can usually be minimized when the feed is brought directly from another refinery unit. If this is impossible and the feed must be brought from storage tanks, then these tanks should be blanketed with inert gas.

MATTIX: We have tried various types of inhibitors on crude exchangers, to stop fouling. At present I think we've run out. We have stopped our test program with no results. On cat crackers we have tried various inhibitors. We have found no results there. We definitely know, on cat crackers, that if we put feed out in storage, let it set for a period of time, and bring a lot of feed in, our exchanger fouling rate goes up fast. This does sound like dissolved oxygen.

HOUSTON: We had one little wrinkle that showed up on a crude unit which was equipped with an electrical precipitator for desalting. We originally injected the desalter wash water downstream of the crude preheat exchanger. We got fouling in the crude preheat exchangers where we were taking them off and water washing these exchangers about every 2 or 3 months. So we moved our injection point to where this water, which is about 5 to 7% of the crude, is injected into the crude charge ahead of the preheat exchangers. We've lengthened the life of those exchangers from 2 or 3 months up to about a year, sometimes a little better, before having to take them off and water wash them. That was caused by the deposition of salt from West Texas crude.

JANDACEK: At Duncan, we had an exchanger-fouling problem on the slurry-to-raw-oil exchanger on the cat cracker. It was solved successfully by stripping the feed from storage with fuel gas. We have also used gas blanketing on our Unifiner feed tankage to exclude oxygen.

GEORGIAN (American Oil Co., Texas City, Tex.): I might say, on our cat cracker feed, we just strip the oxygen out with a fuel-gas stripper, which helped the preheat situation considerably. I believe it was Houston who was talking about adding

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the water to the crude preheaters. We are just starting to try that also. I was wondering if you have any other comments on additional benefits other than the exchangers. Have you been able to save heat or been able to save equipment, or does the desalter work better?

HOUSTON: Yes, it does have, of course, the corollary of improving thermal efficiency of heaters for a given run. In other words, by decreasing this fouling and extending the life between water-wash periods, the exchangers operate with higher heat-transfer coefficients, which is reflected in a savings of fuel gas. We find no difference in the operation of the desalter. I think the two go pretty much hand in hand—this lower fouling rate and the increased benefits from thermal efficiency to reduce fuel gas.

BANKS: What are the causes of and corrective measures for vibration in coils of a gas-fired naphtha heater on hydrogenation preheat service?

KLINE: These symptoms would indicate that "slugging" is taking place due to two phases flowing through the heater at relatively low velocity. It can probably be eliminated by either increasing the velocity through the heater tubes or increasing the amount of preheat so that the heater is operating on a vapor feed.

BANKS: Has anybody had experience with Cronox C as an inhibitor similar to Eastern States' experience?

MADDOX: We started our Cronox C approximately a month ago, after visiting with Eastern States and Crown. I don't think anyone is here from either one of those refineries, but they both have very high praise for the Cronox C method. I'm still not completely satisfied with all the aspects of it, but generally speaking, I think it promises real hope on crude fouling. It looks good, so far.

DANIEL: Have you noticed any effects downstream of the crude unit; that is to say, have you noticed any improvement in after fouling or cat cracking-charge fouling as a result of getting oxygen out at the crude unit?

MADDOX: We haven't been operating long enough to see any of that.

FLOOR COMMENT: We were curious to know whether we would have to gas blanket all of these downstream intermediate tanks to get benefits throughout the whole refinery? Might be something to look for.

MADDOX: They claim that you don't have to do that with regard to oxygen treating. We're definitely getting some naphthenic acid neutralization. What it is doing to dissolved oxygen, I don't know.

OTTENWELLER (Cities Service Refining Corp., Lake Charles, La.): I would like to ask Maddox whether they've picked up any copper in the streams from the crude unit other than bottoms?

MADDOX: No copper.

OTTENWELLER: Incidentally, for those who don't know Cronox C, it is essentially a copper salt, copper ammonium carbonate salt. We were interested in this downstream treating, but we figured we had to put metal deactivator in our gasoline if we got any copper downstream. We also were still worried about propane deasphalting the bottoms. We believe definitely we get some copper overhead in our propane deasphalting. Those are the problems we're considering before we go about using it. But, as he says, all the comments we received from Eastern States and these other people were that it was outstanding in reducing exchanger fouling.

MADDOX: We're fairly sure all of the copper goes down, none of it goes overhead, even into kerosine. I don't know about gas oil. One of the first things the Cronox people told us to expect was that we would no longer have need for injecting ammonia into the overhead system to maintain pH control. That actually came about on the first day. Previously, we had been using sizable amounts of ammonia for pH control. The need for doing that disappeared within about 30 hours. Cronox C people recommend, to start with, 1 lb. of soda ash per gal. of water. Eastern States eventually ending up with a formulation of 0.9 lb. of soda ash per gal. of water. To this is added 0.2 gal. of Cronox C inhibitor. We started out with the 0.9 lb. of soda ash per gal. of water formulation for an overhead pH of 6.8-7.2.

CHAMBERLAIN (Republic Oil Refining Co., Texas City, Tex.): We have been looking at this Cronox for a month or so, and talked to Eastern States and verified what's been said about the fouling problem on the crude side. However, there is a lot of question about heater fouling. At the time that I talked to them, a month or so ago, they had actually cut the Cronox out of one of their units. They had been running about

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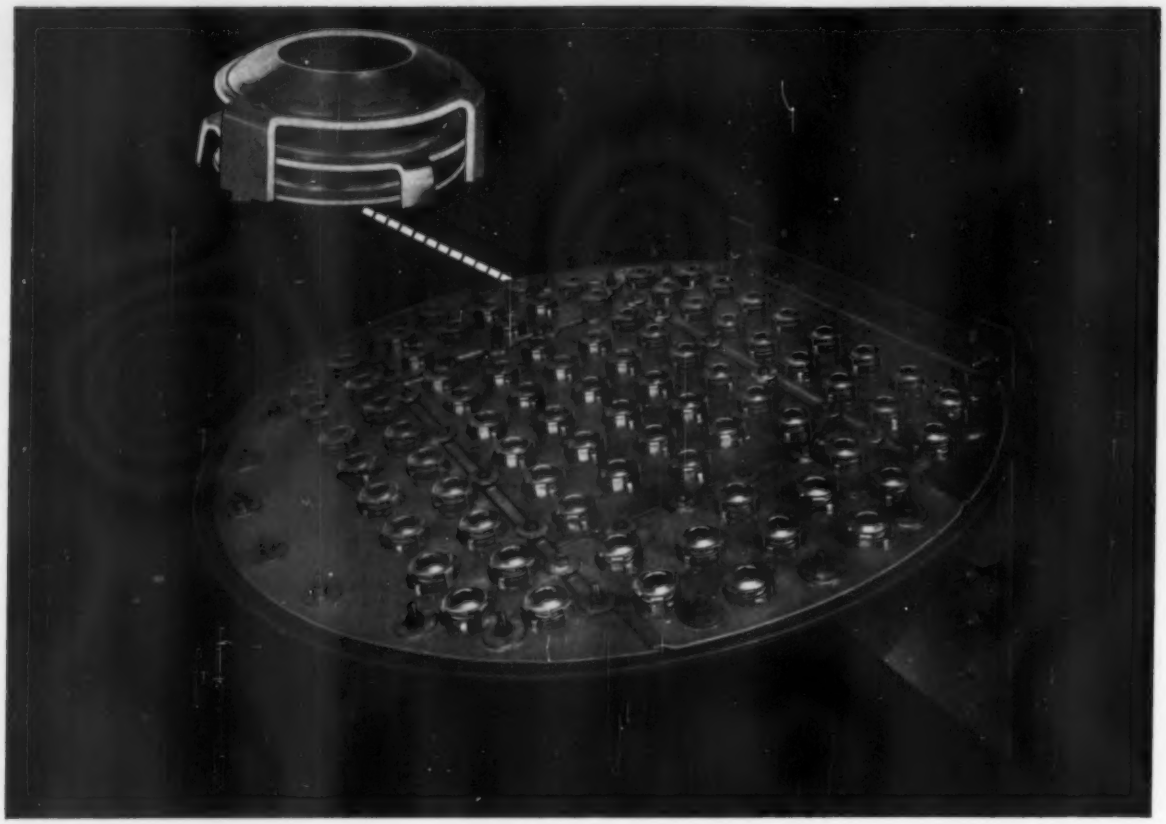

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60 days, but they had to stop and mechanically clean their tubes, and were beginning to get an abnormally high-pressure drop at the end of about 30 days on a crude run. We don't have the exchanger-fouling problem, but we are worried about the heater-fouling problem. We would like to know if anybody has anything on that.

MADDOX: Eastern States normally runs about 750° F. transfer temperature on both of their crude units. We're not anywhere near that number—normally around 680°-685° F. So it is possible that a lot of the plugging in their heater is due to coke deposition.

BOCHOW (Suntide Refining Co., Texas City, Tex.): We have been using Cronox C for over a year in our crude unit and obtained excellent results with respect to exchanger fouling. Before using Cronox C, pressure drop across the final preheat exchangers required bypassing a considerable amount of crude around these exchangers, thus increasing the load on the fired heaters. Since we have used Cronox C, we have not opened the bypass at all due to pressure drop, and the heat transfer has remained at high level. The use of ammonia has been discontinued and we use the pH of the receiver water as a control for the injection rate.

The pH is held in the range of 6.8-7.0 and the iron and copper content have averaged less than 0.5 p.p.m. and 0.1 p.p.m. respectively. With respect to heater coking, we did not have a particular problem before Cronox C injection and, as far as we can tell, still do not have a problem. Comments from people who have talked with Eastern States personnel with respect to heater coking have led me to believe that a difference of opinion existed within their organization, however, I believe results to be good. We have had some difficulty with the vacuum unit barometric jet from a corrosion or erosion standpoint but expect special materials of construction to remedy this matter.

BANKS: What is the consensus on the primary cause of the biological attack on cooling towers? What method have refiners with cooling towers found most effective to combat biological attack on the tower. What's been the experience in terms of years of service using these methods?

COSINUKE: The finding of fungi in cooling towers was great mystery for a time, but now I believe the consensus is that it is nothing more than a natural process. It is just a decaying of dead wood. Redwood has a very outstanding natural toxic extractive. This extractive is generally leached out by continuous saturation and flooding of the cooling tower and is also neutralized by the feed-water treatment. The leaching - out period varies, depending in most cases on the feed-water treatment itself, but has been running from 5 to 7 years. The cooling tower produces an environment ideal for this growth. The moisture, the oxygen, the warmth, and the plant food in this condition exists in a more ideal state than probably anywhere else.

Various methods have been used in treating cooling towers. One is the double - diffusion method, similar to the Forest Products development some years ago for treating poles. The treatment consists of application in two stages. The chemicals used are metallic salt and arsenic acid in the first stage and sulfate or chromate application in the second stage. When these two applications are reacted a toxic material is produced.

A neutralizer follows after these applications. When it combines with the other two and the natural sugars in the wood, it forms a surface that is not readily soluble in water. The initial retentions have been good, and through tests made by refiners in their laboratories, they have found very little leaching. I think the double-diffusion treatment started on towers about 4 years ago is still being continued and is probably the most popular one of all.

MATTIX: I have just one little comment to add there. Where you are putting in a new tower, this wood should be treated before the tower is built. It is so much easier to get it done at that time, rather than wait until the tower is up and conditions get to the point where you have to do it. Order the wood already treated.

McGREW: It should be mentioned that there are two primary causes of delignification of redwood in cooling towers—high pH and chlorine. For minimum attack, pH should be kept in the range of 6-8. Generally speaking, chlorine should be applied at a dosage of 0.1 to 0.2 p.p.m. when added continuously. No more than 1.0 p.p.m. free chlorine should be present when employing slug chlorination.

HOUSTON: We have just one additional comment, and that is that we look at delignification as something separate and set apart from fungus attack. The lignin content of circulating water can be analyzed and is determined by the pH of the circulating water. We have some data that show at a pH of 9 the lignin content is about 5 p.p.m. Dropping on down to 8 pH drops lignin to 2 p.p.m. At 6 pH it drops to 1 p.p.m. So we do agree that the delignification alone can be governed by pH content of the water. We find sulfuric acid to be a pretty cheap way of doing that. We try to hold a pH of about 8, but not above 8. That throws you up around 2 p.p.m.

BANKS: What fume-disposal systems for asphalt oxidation are in successful operation?

JANDACEK: Other than prevailing winds, we don't do much. At our Duncan refinery we have a burner used to burn the gas from the foul-water stripper, which might be tried to get rid of asphalt oxidation fumes. The burner is manufactured by John Zink.

MADDOCK: We had a fume-disposal unit which we used on asphalt production until we quit making it about 5 years ago and it worked reasonably well. The vapors from the oxidizers came over into the field tank in which they were given a water scrubbing through one tray. The vapors then passed over into a burner stack in which they entered at two points, tangentally into the stack, and then we continuously burn fuel gas in this. It did a pretty fair job of consuming these fumes, so that the stack was pretty clean most of the time.

DANIEL: We've had pretty good luck with a fume-burner-type furnace. This furnace is 13 ft. in diameter by 20 ft. high and it was designed for 7,500 standard cu. ft. per hour of fumes. The gas fumes enter the furnace tangentally below six burners and then flow up through the burners and are incinerated. We find a stack temperature of about 1,200° F. seems to do a pretty good job.

MATTIX: We have two units, almost identical, in which we're running crude. One of these units is on what we would call sweet crude, the other is about 40% sour West Texas. We find radical difference in the corrosion rate of the two units, which runs almost directly proportional to the amount of sulfur, in the crudes. The one unit we will be able to keep on stream for 2 years; the other we would have to shut down at least once a year for turnaround. The corrosion at conditions over 500° F. is proportional to the sulfur.

The hydrogen sulfide is considered to be the worst sulfur compound. There was a paper in May 1953, entitled "Estimation of Corrosivity of Crude Oils" presented at the API midyear meeting. This was a laboratory method for comparing the corrosivity of various crudes. It is not a direct method; it is a comparative method which you can use to determine the corrosion rate of an unknown crude by comparing it with the corrosion rate obtained from another crude. There are other things that can get into corrosion on crude units such as naphthenic acid that will cause corrosion in the neighborhood of 300° to 400° F.

BANKS: How can costs be decreased in refinery maintenance?

COSINUKE: Basically, managements of refineries feel that this, by far, is one of the major variables left to be improved. There are four major phases to improve this. The most important one is just plain reduce the amount of work to be done. An important item that will reduce maintenance work is good training of operators. Often something the operator has forgotten to do or wasn't trained extensively enough to know what to do can cause a quarter-million dollars worth of damage.

A number of companies have incorporated link trainers and instrument-control setups. The results have definitely been good, because in a number of emergency situations that came up, the operators automatically did what was necessary without causing too much trouble.

Another important item in reducing work is technical studies, not only in process, but also in the mechanical phases. You do take interest in corrosion, but look also at actual mechanical application, the ways of doing the job efficiently, and how to keep the equipment on stream longer. This shouldn't be confused with preventive maintenance, which is sometimes a magic word for making more work instead of reducing work.

An intelligent approach has to be taken in a preventive - maintenance program. Technical - studies groups should go into the various areas in refineries and study carefully to determine just what is being done. Are the pumps taken down every 6 months and inspected? Is this necessary? I think that the question becomes more and more important, why do we do these things?

Recently you've seen maintenance costs coming down, principally because less work is being done in refineries or the same amount of work with less people. Cost consciousness is making it more difficult to do anything. I know that most people don't like to hear that. Authorization cuts down unnecessary work. This has proven to be a very important tool.

When authorization is required, economic justification will also be required and not just some whim from a process engineer who decided that it may work. Another important phase is improvement in the effectiveness of work performance. That is a long haul, which includes planning, scheduling, good supervision, and an intelligent approach to preventive maintenance.

The third stage is flexible manpower. You can do all the other phases well, but if you've got a fixed number in manpower at the refinery you pay them so much money and they use so much material. What good is all of your efforts in trying to solve corrosion problems and teaching operators how to do a better job if you are still saddled with a large permanent maintenance force.

I can tell you your maintenance costs for a year without ever looking at your books if you tell me the number of people in your maintenance group. We have heard many arguments in trying to justify a fixed maintenance group, but you just don't have that condition.

How much is a shutdown worth in profits? Lots of refiners wind up with too many men for minimum normal maintenance work, so they have to make work to keep crews busy—and not enough men for maximum maintenance work—so they wind up extending the time of the shutdowns—and their onstream efficiency decreases. Another phase is competition to do any work in the refinery. Specialized contractors should be brought in where it is economical.

KERNS: I have a point of rebuttal here on something very basic in management philosophy; that is the red-tape approach to cost control. I'll state my case in this way. In these highly competitive times, this is no time to become only cost conscious. We want to become profit conscious instead. After all, the end objective is profit, and not cost reduction. By hampering ourselves in the ability to move we don't always obtain maximum profits.

COSINUKE: What happens if you spend the money and then there there doesn't turn out to be profit? If you can justify each job that is to be done, when it should be done, how it should be done, there will be no question about it.

BANKS: When should a process unit be turned around?

COSINUKE: We've seen units where they turn them around every 6 months and we've seen units where they run to what they call "total destruction" . . . I know the 6-month turnaround is not economical. This total destruction, the more I see it, the more I can appreciate it. With the advent of the larger units and especially the integrated units, the onstream factor becomes more and more important.

JANDACEK: I would just like to say that those are probably all important considerations in a turnaround, but some, I would like to add, are the problems of product requirement, availability of storage for your products, and intermediate stocks. These cannot be overlooked and normally play an important part in our turnaround scheduling.

COSINUKE: I would like to cite a case of contract maintenance of a refinery in Sarnia with a 20,000-bbl. throughput and a normal minimum maintenance force of about 52 to 54 men. They had a shutdown 3 months ago and turned it around in 8 days, until oil was put back in. The maintenance crew jumped to 440 people in a 20,000-bbl. refinery, and did the job. Right in the vicinity there are five different plants that we have contracts with.

These people realize that contract maintenance was a good thing, but they all couldn't have the shutdown at the same time. We only suggest and show them the economics, but what their customs and what their management believes is another thing. The refineries there have gotten together and definitely agreed their turnaround will be a certain time. We have been able to supply them with the necessary crafts. For example we were able to put 150 welders in one refinery.

DOYLE (Ingram Oil & Refining Co., Chalmette, La.): We have had successful refinery turnarounds in 7 days. Our units are shut down 1 or 2 days apart depending on storage and manpower availability. We use our refinery personnel to open and clean out all vessels and exchangers. The FCC structure is open, clean, and scaffolded for a contractors' crew on Monday morning. The contractor is usually given the structure and one or two other big jobs. The contractor brings in the necessary large equipment and various tradesmen to get the work done on short order.

Final inspection, closing up, and pressure testing is handled by our own men. The 50 people in the maintenance department assisted by the operating personnel will do twice the work, with quality, and a minimum of supervision than would be obtainable with outside workers. Our boys are interested in getting back on stream quickly and safely and their work reflects this attitude.

COSINUKE: The ideal way of handling contract shutdowns is to have the normal minimum load requirements made up of the refiner's men plus a small number of the contractor's better men, who will swing right into supervision for the maximum requirements. These men know the refinery operations, procedures, safety, etc. They will know the people in the refinery and how everything is to be done. We have one case where we are working side by side with the refiner's forces.

The company's representative, who was very much against contract maintenance, told me this the other day . . . "I hate to tell you this, but I'm saying that it is a fact, that your people have put some competition into ours. With this competitive spirit our people are producing more work, but your folks' productivity is as much or more."

ROMMELL (Sun Oil Co., Philadelphia): Has anyone had any experience with gases containing high hydrogen sulfide partial pressures? That is, above 50 psig. at 600°-700° F., and would they care to comment on what type of corrosion-resistant materials were used?

COSINUKE: The NACE report gives you the corrosion rate and the various materials used.

BANKS: Has anyone experienced excessive plugging of boiler chemical-injection lines? What preventive measures have been tried?

MADDOCK: We had a phosphate-injection line in a boiler, which ran nearly the length of the drum. It was perforated on the bottom for even distribution and it plugged on us, so they changed it and made the perforations on a line about 15° above the horizontal, and kept the line full of the liquid and reduced the plugging. It was one of those simple things.

BANKS: What are the latest methods of reducing interior shell corrosion of floating-roof tanks? What additional precautions are required for crude storage?

HOUSTON: We have a little test data here on Dimetcote No. 3 that might be of interest. This Dimetcote No. 3 is a zinc powder in a vehicle which is sprayed on a thoroughly clean, sand-blasted surface. On top of that is sprayed a curing solution of phosphoric acid. This zinc then bonds directly to the steel—we find that this gives a good coating. We have a test section on one floating-roof gasoline-tank shell that has been in service 5 years, and it is in excellent shape.

We see no damage to the coating due to the scraping of the shoes or the movement of the roof up and down. We find that should pinholes or rust spots occur, the rust does not undercut the zinc coating. It's very easy to repair by sand-blasting and recoating. One thing that held us off of the use of this material is that the military had a ban on motor fuels that had been exposed to zinc. This ban was lifted about a year ago and it opened the door to us. We are planning additional installations on interior of the shells of floating-roof tanks.

MATTIX: I might add that we have a number of tanks with this same material on it and we have found it to be very successful. There is one question that we have, though. We have not coated the bottom of the tanks because we have wondered what a high pH would do to this zinc material. We have left the bottom of the tank uncoated.

BANKS: What methods are being employed to offset liquid and metal expansion on aboveground lines?

COSINUKE: I've heard of people using various balloons in lines, but I think the general engineering practice is still to use expansion loops and relief valves.

HOUSTON: We have one new wrinkle we've been using the past few years. In pumps in hot service where space and net positive suction head (NPSH) were limited, we've been installing spring-mounted pumps where the mounting itself takes the expansion. We've done this on both motor and turbine-driven pumps. These springs are stock items with several manufacturers and can be ordered as a stock item off the shelf. We do use them on hot-reboiler pumps particularly where we are into expansion problems and where NPSH is a problem; we get a close-coupled pump mounted on springs, pretty close to the source of suction.

BANKS: What can be done to prevent salt buildup in reformer effluent coolers?

KLINE: Some refiners add water to the reformer or hydrodesulfurizer effluent in sufficient quantity to hold the salts in solution. If this is done, a water draw can be made from the flash separator in front of the hydrogen stripper, thereby preventing most of the salts from getting into the stripper in the first place.

FROST (Pure Oil Co., Nederland, Tex.): What is the corrosion rate when you start adding water? Do you have high chlorides or are you already protected for it metalwise? In our unit which is an Ultraformer, we haven't run into corrosion in any excessive amount. With chlorides in the charge stream, it would seem as if any water introduction would certainly step up the corrosion rate. Maybe someone else has some experience along this line?

JANDACEK: We have that problem on the Unifiner at Tulsa and are currently injecting water with a little ammonia and inhibitor to reduce corrosion downstream.

HOUSTON: How does this water injection affect the water content of the recycle hydrogen which is reinjected back into the reactors? Do you inject it on a continuous basis at the rates of 20 g.p.m.? Is the water injection ahead of the product separator?

FROST: We're not doing any water injection. I don't know the answer; I can't help.

FLOOR COMMENT: The only experience we've had with salt buildups on exchanger coolers has been so our hydrodesulfurization units pretreat for the reformer feed stocks. We have found intermittent wash works. I hesitate to say how little water it does take. We've got a small rod pump that we use for a 1-minute treat we give these bundles periodically. We may put 2 or 3 gal. on the three banks of exchanger coolers in parallel and maybe once a month we'll have to dose with water. Water is added for about 1 minute at the back of each exchanger cooler. It will probably take about another month then to show any indication of salt buildup on the cooler tubes again. In our particular case the water content is of minor importance because hydrogen passing through these bundles is on its way out of the unit and is not recycled.

EPPARD: Before we built a Unifiner for our Platformer charge, we used to have plugging on our condensers and effluent coolers and we

used a water-slugging method to clean the exchangers. We pumped water into the exchanger train at 15 to 20 g.p.m., for 5-10 minutes and this would clean the exchanger. When they plugged up we would slug them again. We also had to use this on our feed heat exchanger to our stabilizer. It works out very satisfactorily. With this method you are not worried continually about having wet recycle gas.

BANKS: What has been done to prevent plugging of hydrogen-treating strippers with salts?

KERNS: I wonder if others have had our problem—not plugging our desulfurizer stripper prior to our reformer, but plugging everything else downstream. I understand several of our neighbor refiners in Kansas have had this same problem. We have all come to a solution which we're not a bit happy with: steam injection. A Cities Service man mentioned this morning that he had this trouble on startup, plugging valves, burners, on his own unit where he was cannibalizing his make gas. I would be interested to hear his solution.

BRANNIN (Cities Service Oil Co., Ponca City, Okla.): Steaming works very well. We have to steam out the burners several times when we come on stream, before we reach equilibrium.

KERNS: You get them clean with the steamout?

BRANNIN: That's right, it works well.

ADAMS (D-X Sunray Oil Co., Tulsa): I don't think there is any satisfactory solution—if you have chlorides in the feed to the extent that it is a plugging-and-carry-through problem—other than getting a hydrogen pretreater and removing the chloride by water wash in the final condenser. Generally when you do that the problem is cleared up. I have heard from various sources that chlorides very rarely occur naturally in crude and almost entirely come from oil-well and tank-treating compounds. There is a substantial move afoot to remove these offending materials from that type of use and possibly this problem will be eliminated by the cooperation of the production departments in the near future.

MADDOCK: We experienced quite a little bit of plugging in our burners to our heaters, particularly when the reformer went out to contact with the refinery stream where it came from the coker. Chlorides came from the reformer along with a small amount of ammonia compounds from the coker and that contributed to deposit in the burner very rapidly. Burning reformer-product gas we have very little plugging. We licked it the same way the Cities Service people and Vickers have—by steaming. It has done a very good job. Just put the steam in with the gas until you get a pressure buildup on the header to a small degree, then cut it out. It usually cleans it very quickly. Our steaming has been only on a very intermittent basis. A minute or two. We don't have to do it again for maybe a month.

MATTIX: They have brought up this question on burner plugging. We have had trouble in our power house, where we were using a mixture of refinery gas and at times had propane from an alkylation unit going into the gas stream. The propane was caustic-washed but SO_2 was still present. We found that the SO_2 would react with the NH_3 in the refinery gas. We have improved our wash system and the trouble has disappeared.

BANKS: Has anything been done to prevent fires in discharge of air compressors?

MATTIX: We have a 600-hp. compressor on air at about 45-psi. pressure, we were burning a discharge line about every 30 days. This was a rather serious problem. We put small sprays in each cylinder discharge of the compressor, dropping the temperature about 100° with water, and the trouble has stopped entirely. The lubricating oils at high temperatures will coke and build up deposits which finally ignite.

HOUSTON: We've had our share of these same incidents of fires in discharges of air compressors. Some time ago we switched to the soap-type lubricant which was pretty much in vogue to help this problem. Recently we switched to another lubricant, a synthetic lubricant. It is a non-oxidizing or highly resistant-to-oxidation lubricant. We switched all our air compressors to this new lubricant and as far as I know we have had no further trouble. We've been following this so-called practice in the industry of nonlubricated air compressors using carbon rings and carbon pistons. We're doing that on all instrument air, starting air, and are even taking a look at it on plant air compressors.

DANIEL: From these nonlubricating-type compressors, do you have any comment on the carbon-ring versus the water-seal job, from air compressors like Nash?

HOUSTON: No, I really don't. My understanding is that the Nash usually are pretty low-head machines for some services. We have, however, primarily used the nonlubricated carbon piston and rings. We are using them on starting air compressors also.

COSINUKE: Air-compressor-problem fires are generally caused by nothing more than overlubrication. In the big installations in steel mills in Canada, it has been licked completely. They cut down the oil supply and they had no fires at all.

BANKS: On cleaning up a unit cooling-water system after a period of poor water treatment, has acid been used to do this and were there any bad after effects?

COSINUKE: An intelligent approach has to be made in this case. The study of the scale and all of the materials in the system must be made to determine the type and strength of acid to be used. Many times in chemical cleaning, people don't analyze the situation properly and the cleaning becomes ineffective. It is a very important tool in cutting costs in maintenance. In the case of water, I think the procedure is to use low acid concentration and high circulation for slow controlled reaction. An inhibitor should also be used. The system will require a good flushing and all spots should be checked in the system, to make sure the acid is out of it. This method has proven to be an extremely effective and economical proposition.

KERNS: I would like to reinforce Cosinuke's comment on the need for study of deposits as well as the materials of construction. We went into our crude unit and attempted to clean it up after a period of poor water conditioning. We had deposits throughout the whole cooling system. We used inhibited HCl and "just kept at it to do the job." What we did was corrode out a lot of box coolers, because the deposit turned out to be high in sulfates and low in carbonate. The sulfates apparently are much more refractory so we didn't do a good job on anything but metal.

Part 1 on Cat Reforming appeared February 23; Part 3 (Coking) will appear March 9; Part 4 (Alkylation) on March 16; and the concluding installment, Part 5 (Cat Cracking) on March 23.

NEW DUALAYER PROCESS TAKES MERCAPTANS FROM GASOLINE... MONEL HOLDS DOWN CAUSTIC CORROSION

The new Dualayer process, developed by Magnolia Petroleum Company, takes out 98 percent of the mercaptans — and at a lower cost than sweetening. It brings the gasoline into intimate contact with a water solution of potassium hydroxide and cresylic acid. Mercaptans dissolve in the solution, which is then separated from the gasoline, stripped in a thermal regenerator, and recycled.

Where corrosion could cause trouble...

As the caustic-organic acid solvent is heated for stripping, it becomes too corrosive for steel or ordinary cast iron to handle. So—designers turned to Monel* nickel-copper alloy for the stripper preheater, reboiler, and bottoms pump. The stripper tower has Monel alloy trays and lining.

Monel alloy is a workhorse in refinery "tough spots"—where heat and corrosion make short work of more common materials. For help with your corrosion problem, write Inco's Development and Research Division. For specific information on Inco Nickel Alloys in caustic service, write for Bulletin T-6.

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67 Wall St. New York 5, N.Y.

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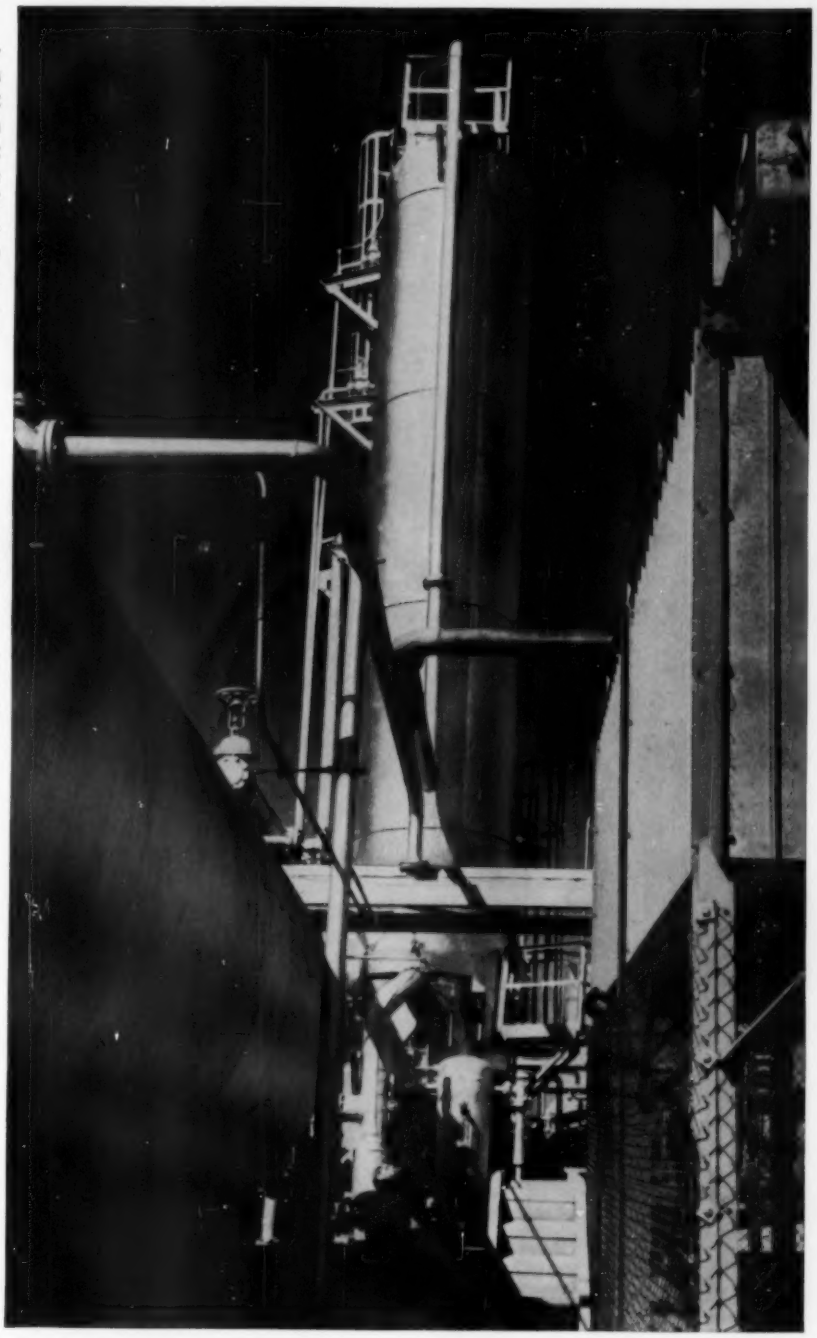
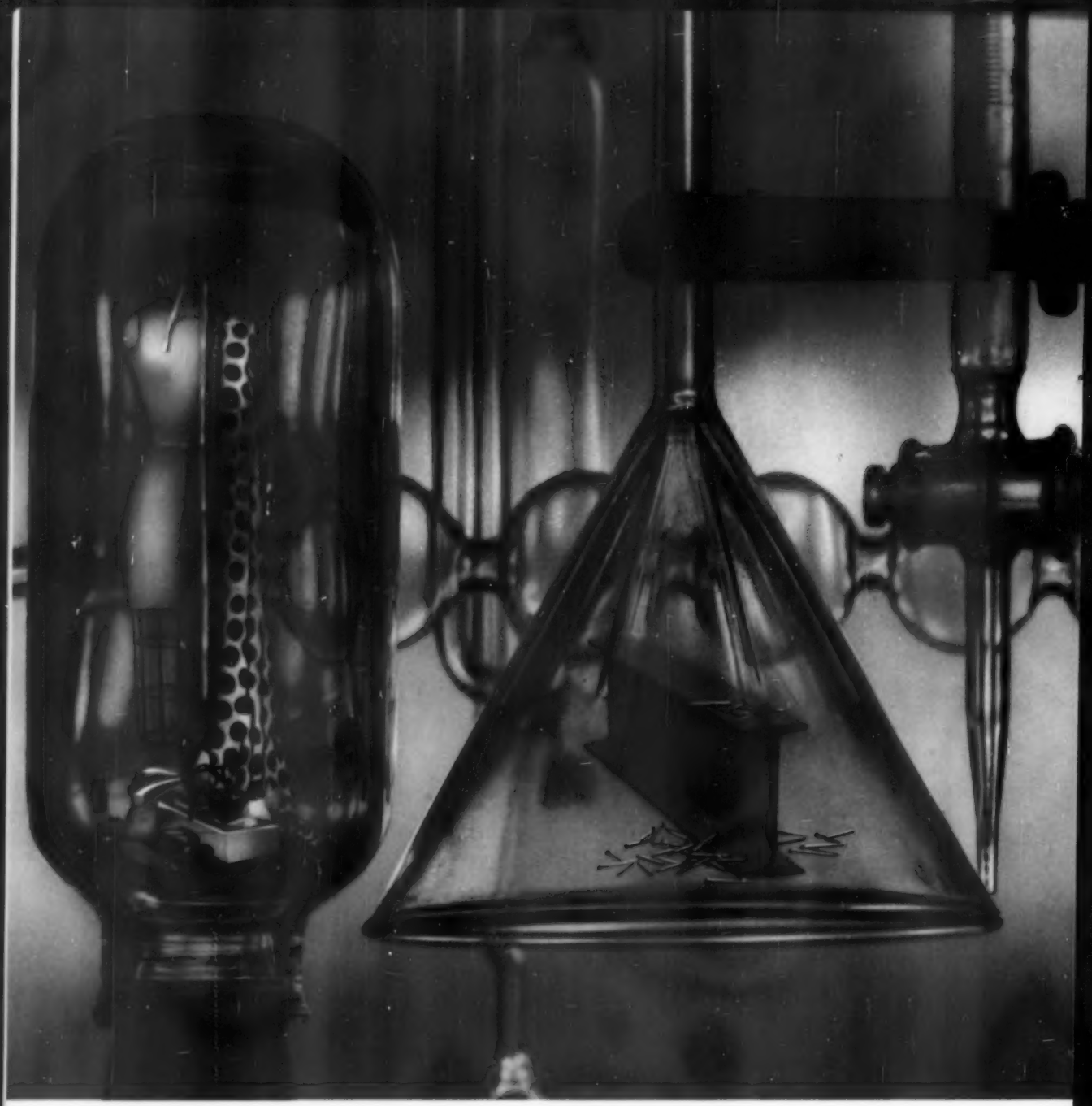


Mercaptans are stripped from potassium cresylate Dualayer treating solution in tower containing Monel nickel-copper alloy trays and lining. *Photo and information courtesy of "Industrial and Engineering Chemistry", and Magnolia Petroleum Company.*

INCO NICKEL ALLOYS



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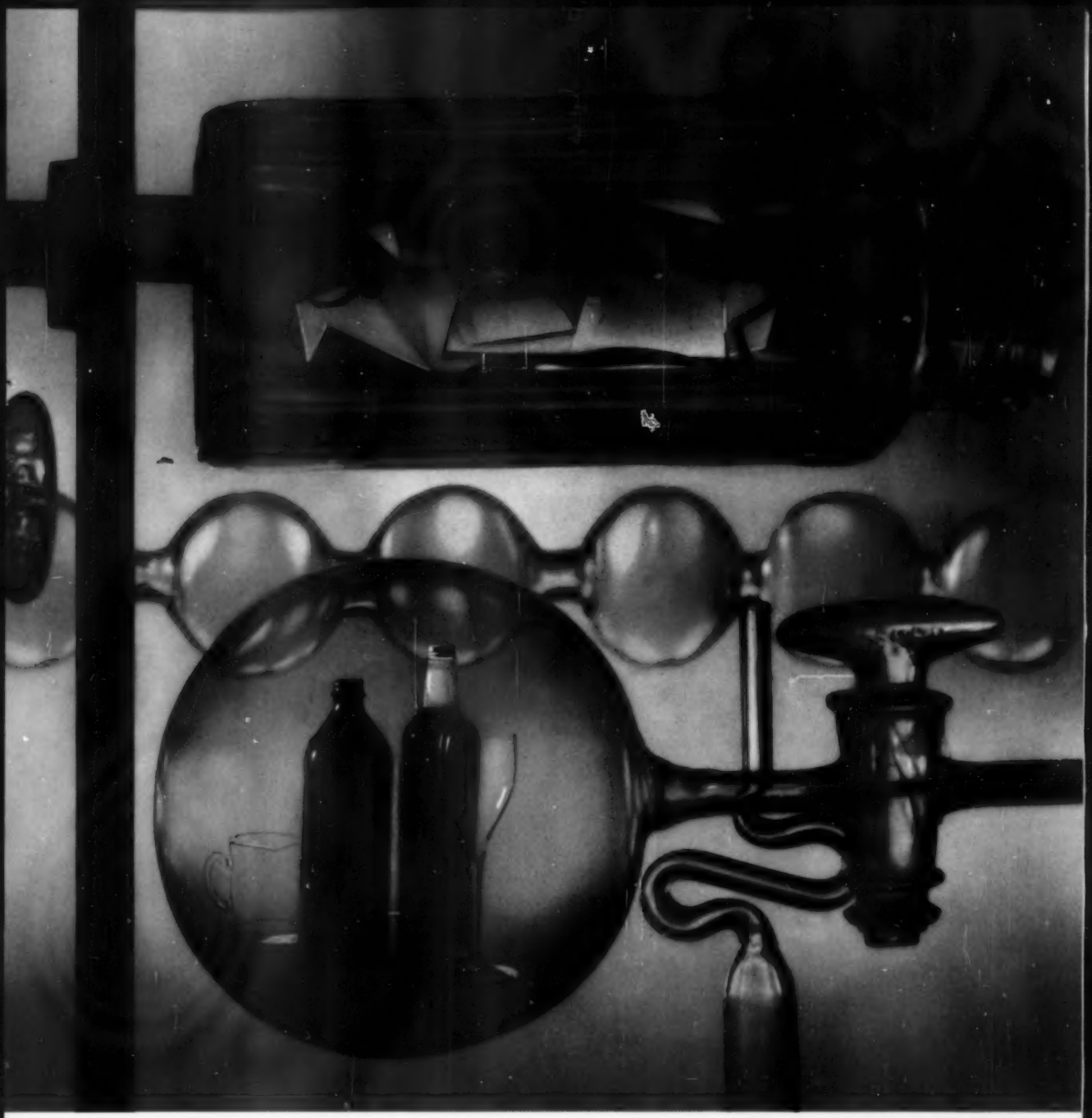
Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in fourteen principal cities. In Canada: Standard Chemical Limited.



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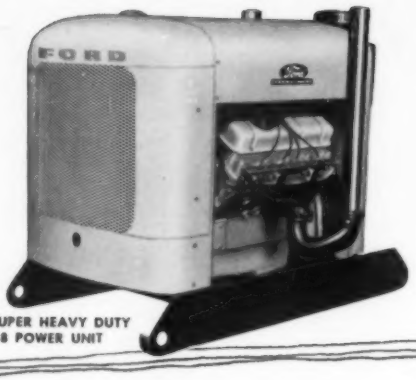

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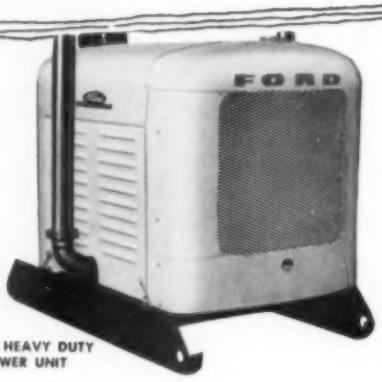
Announcing...the addition of four new FORD Heavy Duty Power Units!



477 SUPER HEAVY DUTY V-8 POWER UNIT

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Now . . . all Ford Industrial Engines are available as engine assemblies or power units!

● These four new power units are built to handle your toughest work dependably and at low cost. Now from 134 to 534 cubic inches, there's a Ford power unit *right* for your job. The Super Heavy Duty V-8's, for example, offer many advances like fully machined combustion chambers, new fuel and lubrication systems, and more horsepower per pound of engine weight than ever before.

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220 DIESEL 4-CYL. POWER UNIT

134 4-CYL. POWER UNIT

172 4-CYL. POWER UNIT

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272 V-8 POWER UNIT

332 V-8 POWER UNIT

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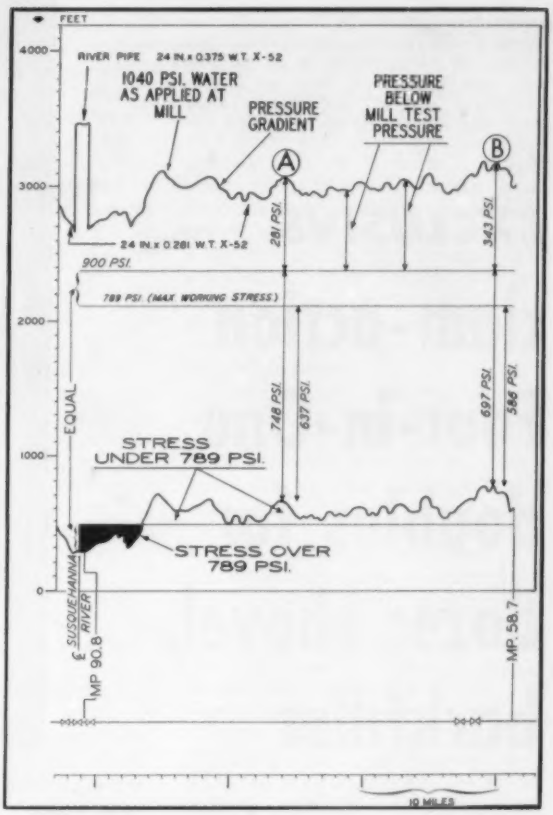
Water-test nomograph tells source pressures

A WATER-TEST nomograph has been developed by M. G. Jordan, chief engineer for Laurel Pipe Line Co., for determining the pressures to be applied to the pipeline at various water sources. Pressure is set at the point of water introduction so that all sections of the pipe to be tested from this source will be stressed to the proper point.

Stress and pressure can be determined graphically from the line profile at any point.

An example of the use of this chart is shown at the Susquehanna River on the Booth to Mechanicsburg section. For this example, 900 psi. would be applied at the river, which would yield a stress of 748 psi. at Point A and 697 psi. at Point B, as compared with the maximum working stress when pumping products of 789 psi. for 24 in. by 0.281 wall thickness X-52 pipe. Pressure (psi.) at any other point can be calculated by measuring the vertical distance in feet between the profile of the pipeline and the horizontal 900 psi. line, and multiplying by 62.4/144 or 0.433.



NOMOGRAPH offers means of assuring that all sections of pipe are stressed properly.

The horizontal line labeled 789 psi. represents the physical characteristics of applying 789 psi. at the river.

Also shown on the chart (lower profile of line) is portion of pipe stresses above and under 789 psi. when applying 900 psi. at the river.

Oil-soluble inhibitors may solve corrosion problems

THE USE of oil-soluble inhibitors in the protection of products pipelines from internal corrosion due to presence of oxygen and water is growing rapidly.

Several pipelines of major size have switched from dehydration or water-soluble inhibitor protection to oil-soluble inhibitors. This type of inhibition got its real start in products pipelines which in the early days required almost weekly scraping at considerable expense and inconvenience.

Most new pipelines are now starting up using these materials any many of the older lines using other methods of protection have switched to oil-soluble inhibitors. From a purchased inhibitor, The Texas Co. switched several years ago to a corrosion inhibitor developed in its own laboratories. The present dosage in pipelines is 6 lb. per 1,000 bbl. The results have indicated that complete freedom from rusting has been obtained. Few, if any, scrapers were required and the throughput has remained at the initial design level.

Most of the pipeline rust inhibitors are now added at the refinery where closer control over the addition can be maintained. In most cases, the inhibitor is added in the final fuel-blending operation.

The only problem encountered is when the blending stocks have not been completely freed of strong alkali or spent doctor. In these cases, and when the tank-bottom water is materially above a pH of 10, most inhibitors tend to form soaps which may be insoluble in the product and usually result in a reduction in rustproof tendencies.

Laboratory tests and actual performance in pipelines have demonstrated that currently used oil-soluble inhibitors are compatible in pipelines. In one pipeline system five different oil-soluble inhibitors are being added, one by each company using the common pipeline. Tests and performance in pipelines also have demonstrated that oil-soluble inhibitors can be safely handled in water-soluble (sodium nitrite) inhibited pipelines.

In lines without serious internal rust, a few parts per million of inhibitor in fuel is more than sufficient to create a monomolecular film of inhibitor on hundreds of miles of pipeline and associated tankage. If heavy

From "Oil Soluble Corrosion Inhibitors," by W. S. Quimby, The Texas Co. Presented before NACE Canadian eastern regional meeting, Montreal.

Extending tank farm fire walls, Robert L. Moore Construction Co., Montgomery, Alabama, handles all the operations to do the whole job with their TD-9 4-In-1. They use it as dozer, "carry-type scraper," and clamshell—to build, slope, and finish-grade the fire walls!

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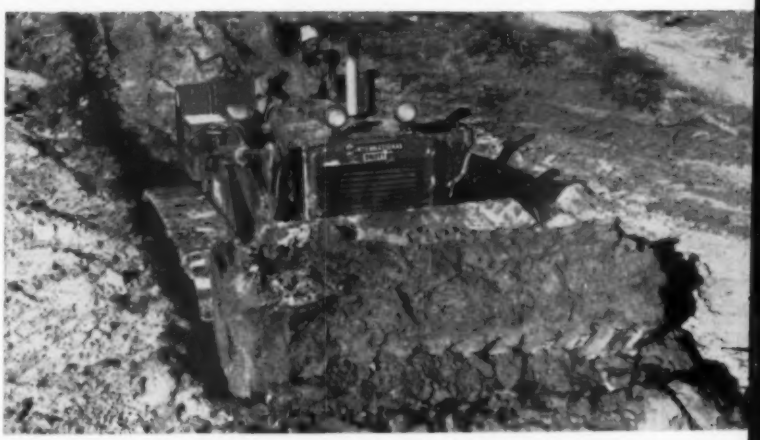

After stripping-off brush and topsoil, this 3-cu. yd. 4-In-1 applies the tremendous power of genuine pry-action break-out—digging a slush pit. Able to handle tough dozing, clearing, excavating, and material production, the 4-In-1 also provides the fastest loading performance available!

An example of versatility unlimited, this TD-6 4-In-1 is backdragging with clamshell action to backfill. For pipe padding ahead of backfilling, controlled bottom-dumping of the clam can feed material gently on the new-laid pipe. (An angledozer attachment is available for fast side-cast backfilling.)

International Harvester Company, Chicago 1, Illinois
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rust and deposits are present, inhibitor will be absorbed on the surface of these materials.

Spongy rust and scale presents a much greater surface area than does clean steel and the inhibitor is removed by absorption as it tries to completely blanket the available surface. This condition exists for a period of perhaps a few weeks until the rust becomes coated with inhibitor.

It is not necessary to run scrapers in pipelines once the initial rust and scale have been loosened and removed. There are numerous examples of both old and new lines where, following the removal of loosened scale and heavy rust, lines were not scraped for at least 4 years. When a scraper was finally run, no quantity of rust was removed and only a slightly cloudy stream was obtained as the scraper was received at the end of the line.

Here are safety fundamentals

SAFETY in pipeline maintenance starts with the design engineer.

Much of the safety battle is already won for the maintenance crew if a manifold or pump station or tank farm is designed to give room to work safely, room to bring in and use proper equipment, and designed without "booby traps," which must be removed after the system is constructed and placed in operation.

Many features in pipeline systems were unsafely designed and had to be corrected after the system was placed in operation in order to make it safe for the operating and maintenance personnel. As an example, across the tops of the boilers in the pump stations on one line are catwalks carefully designed and constructed with hand rails and nonskid floor plates to walk on. But across these walkways about 5 ft. high and spaced 20 ft. apart, were steel beams which had to be ducked under.

These same boilers were the latest thing in design and efficiency, but they tower high above the floor and came without ladders, platforms, or any other provision for reaching gage glasses, alarm whistles, etc., so that all adjustments and repairs to this equipment had to be made from a portable 20-ft. ladder.

It should have been apparent to the designer that an operator could not carry tools up the ladder and make repairs without risking a fall. In this instance, a hydraulically operated platform was designed and constructed so that it could be rolled into position and safely elevated to the desired height.

In the pump rooms of these stations the piping is located in trenches covered with steel floor plates. Each plate is 3 ft. by 5 ft. in size and weighs about 250 lb. Originally, these plates were manhandled with a man and a hook at each end. But after many back injuries and damaged toes and fingers, a plate remover was designed to run on wheels and made so that one man could easily handle the plates and safely stand several feet away while doing so.

Pipeline construction and maintenance methods have changed from those employed by the last of the old rough and tough Irish pipeline gangs laying screwed pipe with pipe tongs, or using the early acetylene method of welding, to the present methods with its streamlined mechanized type of construction and maintenance, using electric welders, boom trucks, pneumatic equipment, modern trenching equipment, etc. The changes have been varied and great during the last 30 years and many of them have affected the safety problem.

Yet, to the maintenance men in the field, the problems may seem the same when the crew climbs off the truck to start a job and it is at this time

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that a short, to-the-point safety discussion can be most effective. This type of safety discussion is often referred to as "tail-gate safety" or "on-the-job safety." The discussion is directed by the pusher, lead man, or foreman and relates to the specific hazards of a specific job. It doesn't differ from any other aspect of safety in its general aim; the only difference is that it can be more forcibly presented by the man who is actually handling the crew.

In order that a lead man, or pusher, can discuss the job in these terms, it is of course necessary for him to have been informed by his supervisor or foreman regarding all phases of the job, such as how he wants the job done, what is to be accomplished, when it should be finished, etc.

After the foreman has issued his instructions to the pusher, it is then necessary that the pusher thoroughly analyze the job himself, to determine what he needs in tools and material, how he plans to accomplish the job, and what hazards he may encounter. After he has planned and lined out the job, he is then able to instruct his crew.

These instructions are generally issued at the scene of the job. This has the advantage of being on the job to indicate hazards and lay out the work where it can be visualized by the crew members. There may be instances, however, where it is advisable to hold this tail-gate meeting before leaving the yard.

In any event, the men are called together, the job explained in terms of what is to be done, how it is going to be done, tools and material that will be used, what each individual's duties will be, and what specific hazards may be anticipated and how they may be overcome.

Even though a man is a laborer or roustabout, he has a head on his shoulders. You know, yourself, that you take a greater interest in a job when you know what is being done, what will be accomplished, and why it is being done. Through tail-gate safety, this interest is added to every job. In addition, every man will know what the others are to do and will be better able to anticipate their actions. Further, it may be that individual crew members may think of additional protective measures, or more efficient methods to incorporate into the specific job. An employe informed on what he is doing, why he is doing it, and what his individual efforts will accomplish, is a more efficient, happier, and safer employe.

The following is an example of on-the-job tail-gate safety and job planning in welding a patch over an oil leak on a crude-oil trunk pipeline.

The leak has been repaired with pipe patch and clamps. The foreman has informed the pusher that the pipeline dispatcher has been notified of work to be done and location, and the pressure in the line has been reduced for greater safety while repairs are being made. When the pusher and crew arrive on the job, the pusher sees that the equipment is parked at a safe distance, checks the bell hole for size and easy access, calls the crew together and lays out a plan of operations.

He assigns someone, usually the welder, to inspect the repair patch, check bell hole for vapors, and get welding equipment ready for operation. He assigns a helper for the welder. He assigns one or more men to get fire extinguishers ready and to stand by the extinguishers during welding operations. He sees that danger signs are properly placed, and assigns some one to flag traffic if work is near a heavily traveled highway. After all details have been checked and each man is aware of his particular duties, then the actual welding operations can be carried to completion.

Advanced planning is one of the keys to supervision. Through planning we can instantly foresee and eliminate accident causes; we can increase efficiency by reducing the delay in securing needed material and equipment, issuing orders during the course of the work, and avoiding other delays brought about by failure to plan our work.

One result of tail-gate safety is better supervision. The pusher whose responsibility it is to give a workman a job to do, and to see that it is done safely, is in a better position on the job site to deliver a safety message on the unsafe act which might cause an accident.

Adapted from "Safety in Pipeline Maintenance," by W. D. McBride, Shell Oil Co., presented before Western Oil and Gas Association safety conference, Bakersfield, Calif.

S. E. HUEY & CO.

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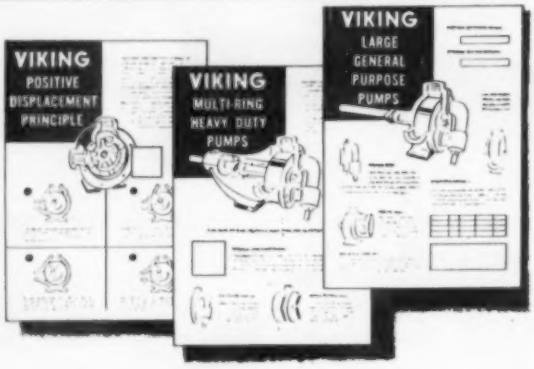
OUACHITA BANK BLDG.

MONROE, LA.

SURVEYING & MAPPING

PIPE LINE SURVEYS

PUMPS ON YOUR MIND?



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VIKING ENGINEERING DATA

VIKING HEAVY DUTY PUMPS

VIKING GENERAL PURPOSE PUMPS

A 36-page pump engineering manual is yours for the asking. It fully explains the 10 easy steps in selecting Viking rotary pumps. Ask for catalog KT.
Available in 10 to 1050 G.P.M. sizes, these rugged Vikings are suitable for pressures up to 200 PSI. Complete with specifications, performance data, etc., they are illustrated in the 24-page catalog CT.
These Viking Pumps—in ⅔ to 1050 G.P.M. sizes—are suitable for pressures up to 100 PSI. They are fully illustrated and have specifications, performance data, etc., in the 36-page catalog BT.
All Viking Pumps are positive displacement pumps and deliver either thin or thick liquids.

VIKING—the leader, not a follower, in Rotary Pumps

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps

See Our Exhibit, Booth 57, California Building

MAY 14-18, 1950
Tulsa, Oklahoma

THERE'S A BETTER WAY...to protect pipelines against corrosion; combat chemical contamination!

Whatever your corrosion problem, a Glidden protective coating system will provide *real umbrella protection;* give you positive control of corrosion and chemical contamination.

Each Glidden system is the result of extensive research and testing, and has been proven in numerous industrial applications. NU-PON COTE, for example, is widely used for protecting pipelines, storage tanks, oil field equipment, chemical and industrial plants—wherever excellent resistance to chemical fumes, general solvents, water, alkali conditions and abrasion is required.

As a part of Glidden Technical Service, our field engineers will analyze your particular corrosion problem, and recommend the system designed to give you positive protection at lowest maintenance cost.

Make sure you get both—Glidden maintenance coatings plus Glidden Technical Service—for *real umbrella protection.* Write for details.

"THE GLIDDEN UMBRELLA"
of protection combines comprehensive technical service and tested formulations of maintenance coatings for all industry.

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He's a giant steelman. He makes good steel and steel products for the diversified needs of today's economy. He anticipates tomorrow's requirements. He is constantly improving products through research and new manufacturing techniques.

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He is the dynamic image of CF&I . . . the symbol of dependable steel products. Look for him when you buy.

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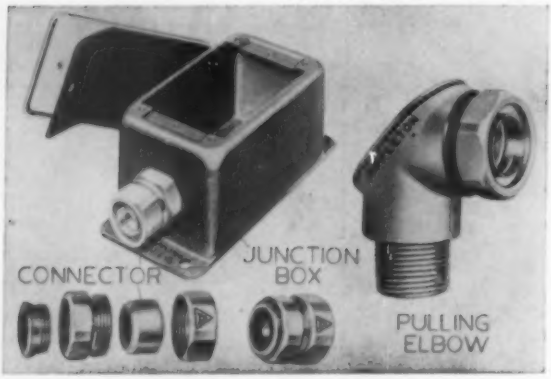
40 Warehouses and 60 Sales offices located coast to coast

THE COLORADO FUEL AND IRON CORPORATION
DENVER • OAKLAND • NEW YORK

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



LIQUIDTIGHT electrical wiring systems possible with . . .

New junction box, pulling elbow

. . . and connector recently developed. The JIC Series junction box is ruggedly built so as to be both liquidtight and dustproof. Approved for use either as a junction box or a wiring-device box, it is engineered to give protection from liquids, fumes, dirt, and other foreign matter. Of one-piece welded construction, it can be obtained equipped with the STN four-part connector designed to eliminate lock nuts or O-rings and to give plenty of wiring room inside the box.

One wrench is all that is needed to join conduit to the connector. When the connector is screwed into position, the continuous metal-to-metal pressure of the wedge adapter in the connector and the connector body against each other and the box wall give a connection with lasting resistance to vibration.

The JIC 90° pulling elbow is not only liquidtight but also weatherproof and dusttight. Its large cover opening gives easy access for pulling wires in any installation. A solid neoprene gasket seals it against liquids, fumes, and other foreign matter. **Write or call: Appleton Electric Co., 1713 West Wellington Street, Chicago 13, for details on JIC junction box, STN connector, and JIC 90° pulling elbow.**

●

Corrosion inhibitor is effective

. . . for aviation gasolines even at low dosages, the maker reports. Only 4 lb. of the inhibitor per 1,000 bbl. of gasoline effectively prevents corrosion. Called AFA-1, the aviation fuel additive is expected to find wide application. It contains about 5.3% phosphorus by weight. Ash content is extra low. The additive is effective in both many types of finished products and refinery stocks. **Write or call: E. I. du Pont de Nemours & Co., 8452 Nemours Building, Wilmington, Del., for details on AFA-1 additive.**

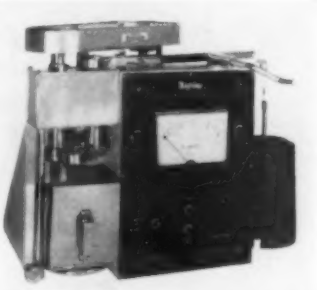
●

Four-blade insert bit for shot holes

. . . promises faster penetration in harder formations than was possible with older types as well as smoother drilling without loss of gage size of the hole, according to the maker. Equally effective in air or water drilling, the four-blade unit with a four-blade shank is interchangeable with the maker's three-blade units in the same type of bit body.

Alloy bar flats to speed breakout are welded to the steel body. The bit is available for box or pin connections. The blades are replaceable on the drill which permits the use of several sets with one bit body. **Write or call: Herb J. Hawthorne, Inc., P. O. Box 7366, Houston, for details on four-blade insert bit.**

●



Extreme-pressure mud tester

. . . for checking the lubricating properties of drilling mud is now available. The unit is compact and suited for field use. It determines the extreme-pressure lubricating properties of mud by rotation of a test ring at high speed against a standardized steel test block to which a measured load is applied.

Send this **Showcase Coupon**

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

Described in OIL AND GAS **JOURNAL** - Issue of **March 2, 1959**

NAME.....**TITLE**.....

COMPANY.....

ADDRESS.....

CITY.....**STATE**.....

SHOWCASE . . .

New Equipment

The test ring and test block are submerged in a container of the mud under test. A sensing device indicates when the protective film formed by the extreme-pressure mud additive has been ruptured and metal galling takes place.

The tester measures 15½ by 14 by 12½ in. and weighs 65 lb. It uses a ¼-hp. motor operated on 110-volt a.c. power. **Write or call: Equipment Div., Magnet Cove Barium Corp., P. O. Box 6504, Houston 5, for details on E. P. mud tester.**

●

Plug valve obtains a tight seal

. . . and requires no lubrication. Called the Wedgeplug O-seal valve, it will effectively double-block and bleed in most services to do the job of two ordinary valves or a line blind.

Operating fast and easy, the valve has protected seats and double seating. The double pressure-sealing effect of the O-rings permits a tight seal upstream and downstream. A drain plug in the bottom of the valve can be removed to check for bleed.

The maker recommends the valve for all general-purpose service, including handling of air, other gases, water, steam, propane, and other hydrocarbons, at temperatures from −300° to 400° F. and pressures to 720 psi. **Write or call: Wedgeplug Valve Co., Div. of Stockham Valves & Fittings, 4006 North Tenth Avenue, Birmingham 2, for details on O-seal valve.**

Bar chart recorder shows time

. . . that machines are in operation and not in operation and so gives a visual picture of the productive effort of up to 40 machines. Operating remotely from a data-processing center, the recorder shows actual distribution of machine and operator time on one chart.

Components of the instrument include a rotating drum that carries an inkless chart and a stylus or writing point. It is connected to machines by a wire. Machines monitored require a small transformer which is easy to install. For 20 seconds every 2 minutes, the recorder checks each machine. If the machine is in operation, the recorder scribes a short horizontal line in the proper chart area. If the machine is idle, no line is scribed.

Two models of the machine are available-Models S and M. Model S has a capacity to monitor 2 to 20 machines, Model M, 40 machines. **Write or call: Gorrell & Gorrell, Westwood, N. J., for details on bar chart recorder.**

Protect Your Machinery with

THOMAS FLEXIBLE COUPLINGS

ALL METAL

NO LUBRICATION · NO MAINTENANCE · NO WEARING PARTS

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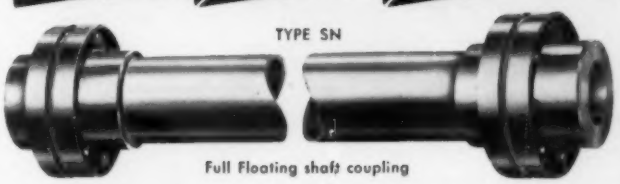


Full Floating shaft coupling

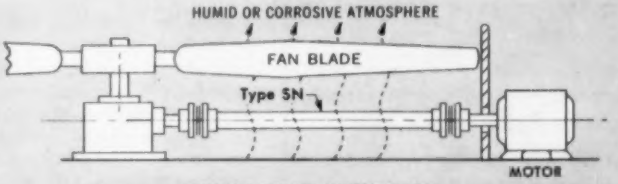
REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance



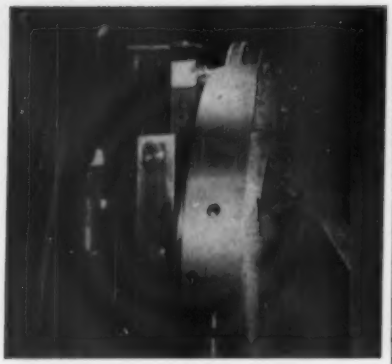
COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

Write for engineering catalog 51A, and the name of your nearest Thomas representative

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.



. . . Refinish Crank-Pins . . . In Place!

● Accurate High Quality Maintenance And Machine Work

The small engine crank pictured above was restored in close quarters without dismantling engine. Our portable machines can solve your problems and save you money. Crank pins from 5½" through 20" in diameter accurately refinished in place at great saving in cost. Let us help you minimize down time.

Worn and damaged flywheel fits refinished in place.

In our shop crankshafts of any size or type completely refinished. Shafts straightened and broken shafts successfully repaired.

Most modern methods used in rebabbitting and machining engine and turbine bearings.

All types of heavy power plant equipment serviced with special attention given to emergency repairs.

Additional information furnished without obligation.

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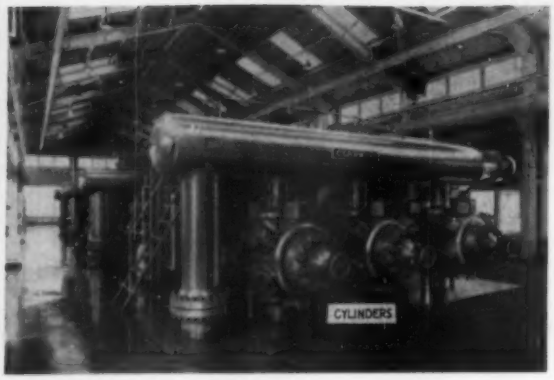


EFFICIENCY remains high with these . . .

Pipeline compressor cylinders

. . . even at compression ratios as low as 1.2 according to the manufacturer. Developed as the result of a 4-year research and field-testing program, the cylinders incorporate several internal design features which have a cumulative effect on improved performance. These include a new valve design that uses nylon poppets, large internal manifolds streamlined to minimize turbulence and pressure drop, and oversize suction and discharge nozzles to keep velocities low.

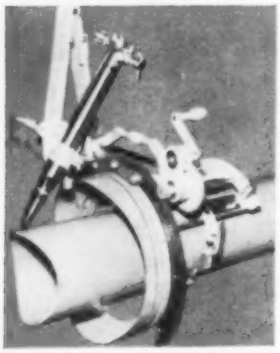
Field tests show as much as 15% improvement in efficiency over previous cylinder designs. The poppet valves are designed to keep gas velocity unusually low. In most applications, double-decking of the valves will not be needed. **Write or call: Clark Bros. Co., Olean, N. Y., for Bulletin 168.**

Automatic data logging system

. . . now available is designed for all applications where a centralized data transmitting and logging system are needed. Called April for automatically programed remote-indication logging, the system can be incorporated as part of a new supervisory system or added to existing GE equipment. It can be used on its own channel or on the supervisory channel when required.

The system converts analog type of quantities to a binary code form and transmits the information from a remote location. When it is received at a master location, the code is converted to decimal form for visual display or logging using an electric typewritter. **Write or call: General Electric Co., Schenectady 5, N. Y., for details on April data-logging system.**

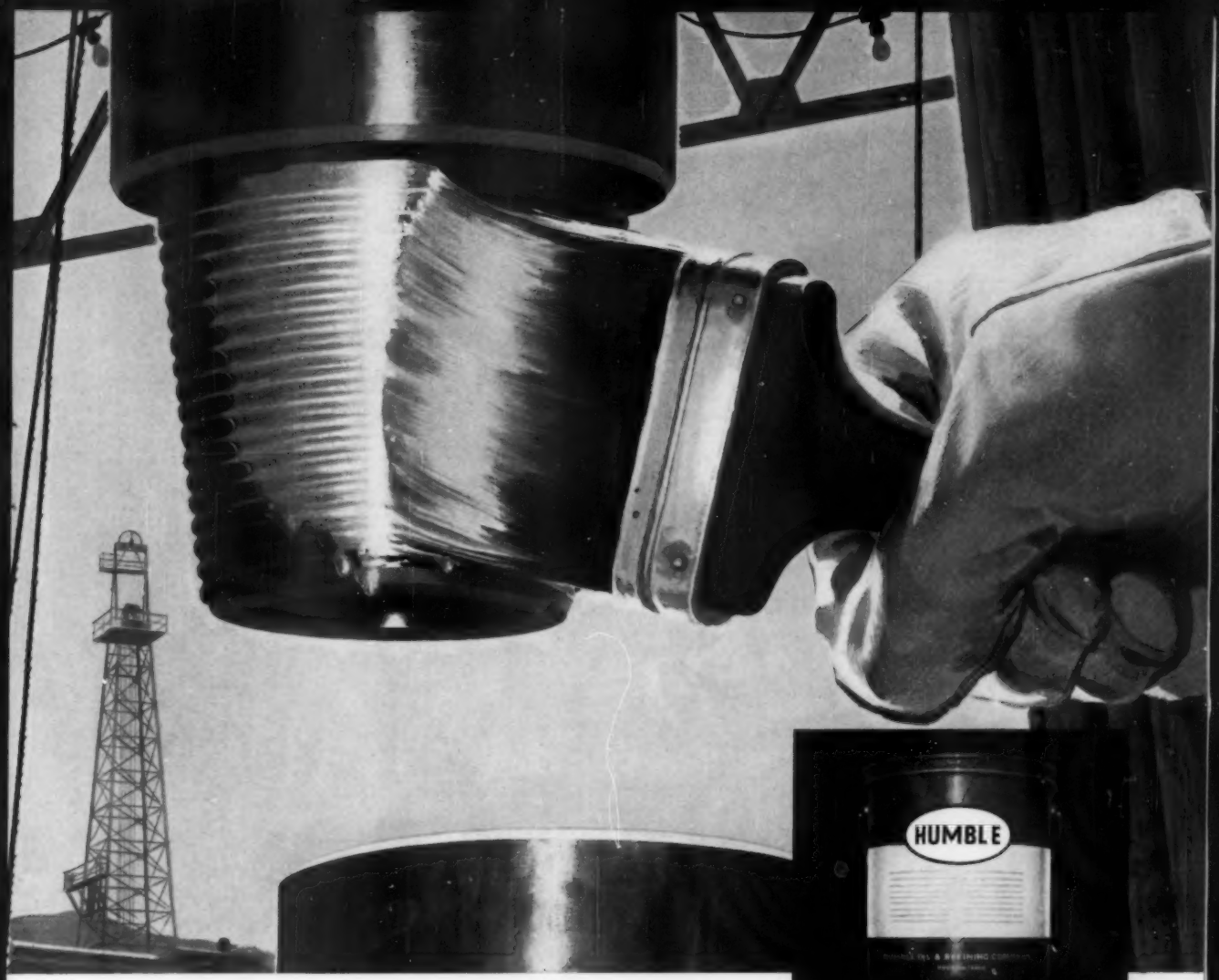
●



Attachments for pipe cutting

. . . and beveling machine have been improved. The shape cutter attachment for H & M machines has been completely remodeled and is lightweight and easy and fast to mount. It is designed to cut various shapes of pipe intersections automatically.

The out-of-round attachment for the same machine now has a free-wheeling roller assembly that turns 360°. The roller rides the pipe surface and automatically makes corrections for imperfections. **Write or call: H & M Pipe Cutting & Beveling Machine Co., 311 East Third Street, Tulsa, for details on pipe cutter attachments.**



THREDKOTE 701

keeps your tool joints on the job

For longer tool joint service, protect the threads from first trip to last with Humble's Thredkote 701.

Give new tool joints a specially careful and generous coat for good lubrication and maximum protection. Continued use of Thredkote 701 on each trip will keep your string running tight and true.

Joints make up tight and break out easy. As the string is run, the 60% pure metallic zinc in Thredkote 701 effectively guards against metal-to-metal contact and prevents galling. And Thredkote 701 maintains its quality and consistency under the most rugged running conditions.

Thredkote 701 is available in 25 lb. pails and in 200 lb. and 600 lb. drums. Call your nearest Humble wholesale plant in Texas and New Mexico. Thredkote is also available through many oil field supply stores. The price is right, and delivery is quick.

HUMBLE OIL & REFINING COMPANY

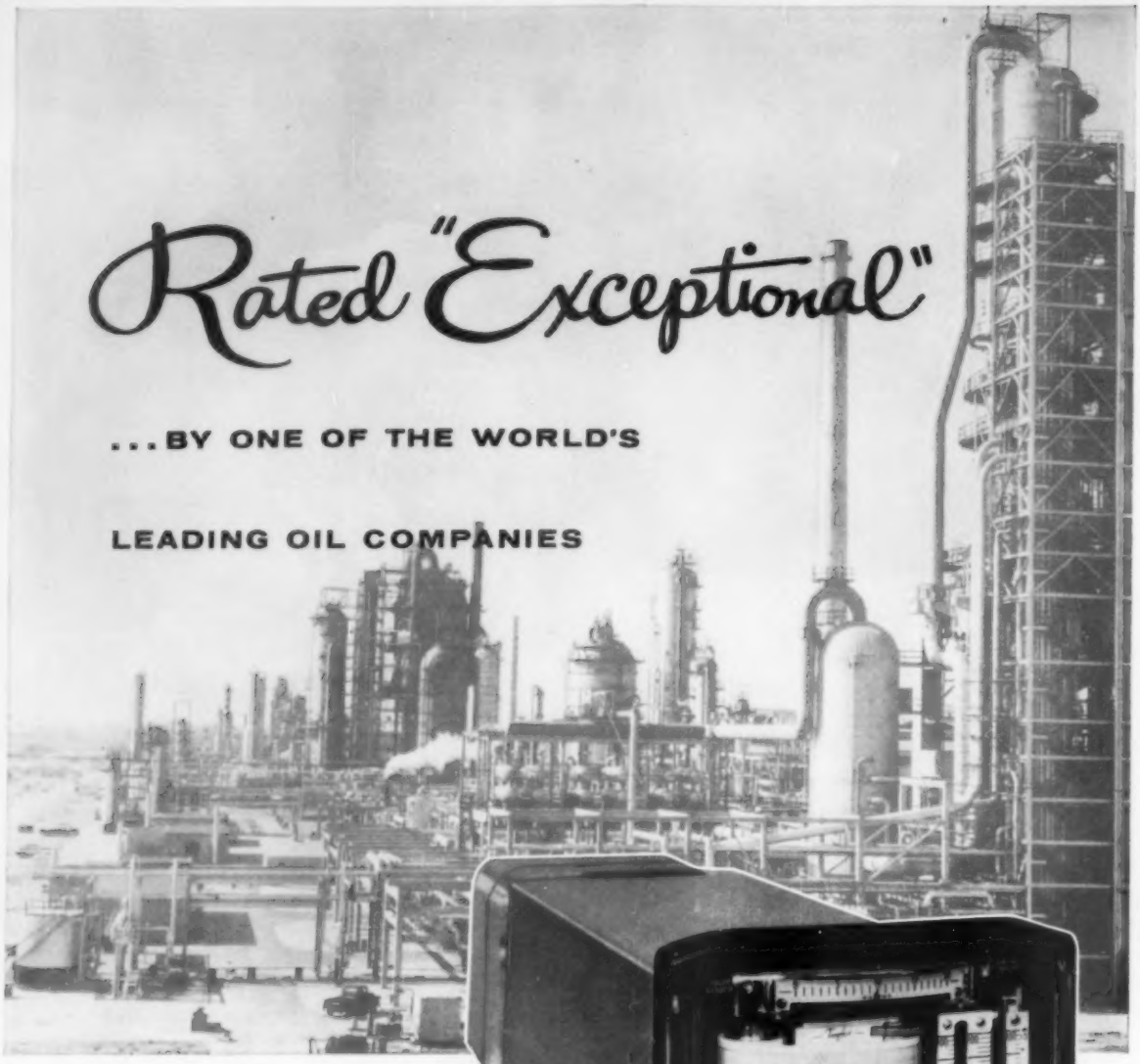
Other Humble Thread Compounds

- **THREDKOTE 700** — lower cost, red lead base lubricant for casing, tubing and tool joints.
- **THREDKOTE 703** — 85% metallic zinc, for use where pressures exceed 2000 lbs. per square inch.
- **THREDKOTE 705** — lubricates, fills and seals worn, wobbly tool joints.
- **THREDKOTE 706** — meets all requirements for A.P.I. high pressure thread lubricants suitable for pressures exceeding 10,000 lbs. psi.
- **THREDKOTE 708** — forms an insoluble seal at threaded connections servicing gas, gasoline, solvents and kerosene.
- **THREDLOK 801** — a new product for sealing and locking casing joints.

HUMBLE

Rated "Exceptional"

...BY ONE OF THE WORLD'S LEADING OIL COMPANIES



An internationally famous oil company recently carried out exhaustive tests on the Taylor 90J TRANSCOPE® Recorder. This particular company is continually testing and evaluating instruments from all over the world.

In the opinion of the qualified specialists of this world-famous company, the performance of the 90J Recorder was outstanding. In fact they were so impressed that they established a *new classification* . . . they rated it "exceptional".

Experience with this instrument has inspired the statement, "No other recorder puts so many features in so little panel space". And it's so easy to prove—make arrangements with your Taylor Field Engineer—to put a 90J TRANSCOPE Recorder on test. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ontario.

®Reg. U.S. Pat. Off.

Look to Taylor for **VISION . . . INGENUITY . . . DEPENDABILITY**

Taylor Instruments MEAN ACCURACY FIRST

Tractor horsepower, weight upped

. . . in new models of the Caterpillar D8 machines. Now available in both direct-drive and torque-converter models, the tractor's flywheel horsepower is 225 hp. as compared to 191 hp. in the older models. Drawbar horsepower on the direct-drive machine is 180 hp. It weighs 47,102 lb. The torque-converter machine weighs 47,875 lb.

A four-cycle, valve-in-head, turbocharged, six-cylinder diesel engine powers the tractor. Its bore and stroke are 5¾ by 8 in. Piston displacement is 1,246 cu. in.

Interesting features of the new machine include lifetime-lubricated rollers and idlers, After lubrication at the factory, they need no further attention. To lengthen the life of the track links, their height is increased ¼ in. and pitch length 1 in.

The transmission on the direct-drive machine is directly reversing in all six speeds. The high forward speed is 6.3 m.p.h.

Available for the tractor are a number of matched tools. These include bulldozers, ripper, and hydraulic controls. **Write or call: Caterpillar Tractor Co., Peoria, Ill., for details on D8 Tractor.**

Hydraulic-pressure-actuated pump

. . . moves abrasive and corrosive liquids at pressures to 5,000 psi. and at rates to over 240 g.p.m. Called the Hydropulse, the pump is a positive-displacement type that uses hydraulic pressure to cause a synthetic pulsator to expand and contract within a pressure chamber. Conventional packing, pistons, and cylinders are not used.

Use of a variable-volume hydraulic pump permits stepless control of pumped-fluid volume. Control can be manual, mechanical, pneumatic, or pressure-compensated. A phasing valve is used to make discharge flow substantially free of pulsations.

A relief valve, pressure gage, and volume control are built into the hydraulic oil system. Standard models have a capacity range from ⅓ g.p.m. at 3,000 psi. to 240 g.p.m. at 650 psi. A number of tests indicates the pump offers a potential application for high-pressure pumping of oil, drilling fluid, and slurries. **Write or call: Pioneer Div., Scott & Williams, Inc., Laconia, N. H., for details on Hydropulse pump.**

PROCESS PLANT MAKER OF TOMORROW . . . . .

Your plant problems in chemical, petroleum, petrochemical and nuclear fields . . . . will be solved by CHIYODA's broad experience in engineering, fabrication and construction.

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President: A. TAMAKI

Cable Address: "CHIYOTAKA TOKYO"

NEW... HIGH VACUUM PUMP from Refinery Supply

the VIBRATION'S gone *and so is the noise with the* HYVAC-7

No. 91505, 60 cy. 115/230 volts
$275.00

No. 91500, same as No. 91505, but without motor or base
$220.00

cenco
The most complete line of scientific instruments and laboratory supplies in the world

Here's a vacuum pump that is so carefully designed . . . so expertly machined . . . so perfectly balanced . . . that vibration has been reduced to an absolute minimum. Result . . . smooth, quiet operation. You can hardly hear it as it runs. In fact, its noise level is lower than that of any similar pump.

The new Cenco Hyvac-7 has more pumping capacity per cubic foot of space occupied than any other vacuum pump now available. It produces a free air displacement of 70 liters per minute and a guaranteed ultimate vacuum of 0.1 micron. This pumping speed in the low micron range is exceptionally high. The ratio of pumping speed at 1 micron to that at atmospheric pressure is 49%. And it pumps from atmospheric to ultimate pressure in less than five minutes.

This finest, most efficient of all vacuum pumps is now ready for shipment.

REFINERY SUPPLY COMPANY
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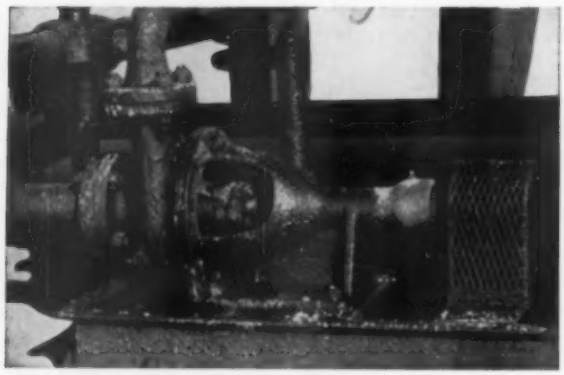


CORROSION CAN'T K. O. THIS CENTRIFUGAL PUMP!

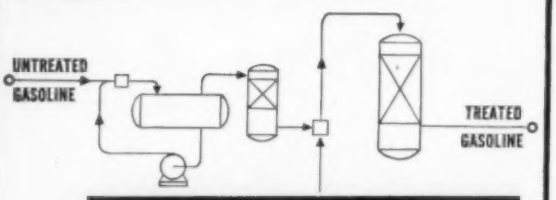
It's an AMPCO®

Ampco protective features include: *Wear rings*—to save the casing; *Shaft sleeves*—to eliminate worn shafts. Repair and maintenance cost less — downtime is reduced.

Available *from stock* in stainless steel, Ampco Metal, and Illium "G." Pumps with elastomer or rubber linings also available. See your Ampco Pump Distributor. Or write for Bulletin P-3b.

AMPCO
AMPCO METAL, INC. P-47
Dept. 169C, Milwaukee 46, Wis.
WEST COAST PLANT: BURBANK, CALIFORNIA
SOUTHWEST PLANT: GARLAND (DALLAS COUNTY), TEXAS

TC SWEETENING



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COPPER CHLORIDE

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Place your confidence in a basic producer of Copper Chemicals.

CUPRIC CHLORIDE DI-HYDRATE
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Other products of interest—
Ferric Sulfate—Copper Sulfate,
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For samples make request on your company letterhead.

TENNESSEE TC CORPORATION
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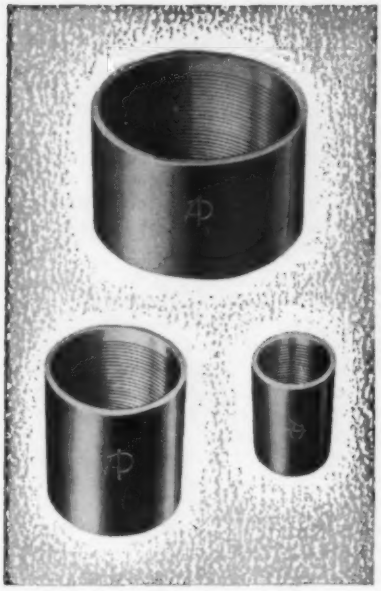

HARRISBURG COUPLINGS

Harrisburg Seamless Steel Pipe Couplings are manufactured to A.P.I. and A.I.S.I. specifications for petroleum and other industries. The Harrisburg developed process assures uniformity of threading unsurpassed in accuracy of form, height, angle and lead. Order the best — order Harrisburg couplings.

More than a Century (H) in Harrisburg 6, Pa.

HARRISBURG STEEL CO.

Division of HARSCO CORPORATION

CYLINDERS

FLANGES

TUBES

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SHOWCASE . . .

New Literature

Electronic-instrument bulletin

. . . gives complete specifications of potentiometer and bridge instruments in indicating, recording, and controlling models. Bulletin P1245-A contains information on new rack-mounting, high-speed, multiport, and miniature instruments, in addition to descriptions of standard round-chart and strip-chart instruments. One section of the 64-page publication is devoted to sensing elements and attachments for use with Bristol Co.'s Dynamaster instruments, which include resistance computing, totalizing, and digital readout attachments. Another section describes the incorporation of these instruments into other manufacturer's equipment. **Write or call: Bristol Co., 17 Bristol Road, Waterbury 20, Conn., for Bulletin P1245-A.**

New meter bulletin

. . . features two new Ironcase meters. The bulletin provides complete details on the capacities, construction, and performance of each unit. **Write or call: Advertising Dept., American Meter Co., 920 Payne Avenue, Erie, Pa., for Bulletin 310.**

Hastelloy-alloy fabrication

. . . is the subject of a new 36-page brochure which covers step-by-step procedures and recommendations for welding, forging, forming, machining, grinding, brazing, heat-treating, descaling, and pickling. It gives information on lining of vessels and corrosion surfacing along with necessary boiler-code data. The brochure is the latest in a series that has included individual publications on Hastelloy alloys B, C, D, and F. **Write or call: Haynes Stellite Co., Le Van Building, Kokomo, Ind., for Fabrication of Hastelloy Alloys brochure.**

Functions of Univac

. . . data-processing equipment are outlined in new available Bulletin U-1363. It illustrates a broad range of basic data-processing functions and shows the specific equipment to execute them. The bulletin explains the techniques of processing unit facts—whether in punched cards, perforated paper tape, or magnetic tape. Once recorded in cards or tape, these facts can be used over and over again. They are processed automatically by high-speed equipment to prepare accounting or statistical reports. The bulletin includes functions and basic equipment of card punching, verifying, in-

YOU ARE DRILLING FOR OIL?

Don't forget—if you are drilling for oil, you are looking for pressure, too—preferably high pressure. When you reach pressure zones, profits can mount fast. But luck can turn to loss without proper drilling and completion controls.

Cameron perfected the first successful controls of this type almost forty years ago. A steady research and design development program has kept ahead of anticipated pressures. Today the Type "F" Preventer shown above is ready to control working pressures to 15,000 psi—this is ten times the working pressure of our first preventer. During all these years successful operators in every oil producing area of the free world have considered it good precaution and good business to COUNT ON CAMERON for the best in drilling and production controls.

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terpreting, reproducing, tag converting, and tape perforating and processing. **Write or call: Remington Rand Div., Sperry Rand Corp., 315 Fourth Avenue, New York City 10, for Bulletin U-1363.**

General-service valves

. . . are discussed and illustrated in new 20-page Bulletin E-165, yours for the asking. The bulletin outlines valve types, typical services, construction, and operating features. It includes drawings, photos, and cutaways. **Write or call: Everlasting Valve Co., 49 Fisk Street, Jersey City 5, N. J., for Bulletin E-165.**

Sight-flow indicators, check valves

. . . are described in new Specification Sheets 10E1200 and 10E1215—each two pages. The sheets give materials of construction, operational limits, and standard models. **Write or call: Fischer & Porter Co., 842 Jacksonville Road, Hatboro, Pa., for Specification Sheets 10E1200 and 10E1215.**

Unit-tandem blowoff valves

. . . for boiler blowoff pressures to 665 psi., are detailed in new four-page Bulletin B-435, Supplement A. It contains full descriptions, operating details, materials, dimensions, and valve advantages. **Write or call: Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, for Bulletin B-435, Supplement A.**

Corrosionproof rigid-plastic fans

. . . are discussed in two new bulletins now available. Bulletin 9-20 describes centrifugal fans featuring sizes ranging from 10½ to 35 in. Bulletin 9-21 details twin-flow fans available in sizes ranging from 12 to 48 in. According to the bulletins, the fans are made from Ampcoflex Type 1 polyvinyl chloride and offer exceptional chemical resistance with high-structural strength in relation to weight. **Write or call: Atlas Mineral Products Co., 121 Norman Street, Mertztown, Pa., for Bulletins 9-20 and 9-21.**

PVC piping, fittings, and valves

. . . are detailed in new six-page Folder 10050-A, which covers both normal and high-impact material. The folder lists complete specifications and physical properties of Koroseal piping and includes data on common chemicals that can be handled safely by this vinyl chloride polymer. Koroseal's strength is from 1,000 to 7,000 psi., depending upon the amount of plasticizer. High-impact Koroseal PVC pipe is designed to withstand severe shock loads and unusually rugged operating conditions, according to the folder. The material retains its impact strength and corrosion resistance over a wide temperature range. **Write or call: Plastic Products Div., B. F. Goodrich Industrial Products Co., Marietta, Ohio, for Folder 10050-A.**

Dew-point, controllers

. . . using a system known as Autocarb, are outlined in new six-page Folder SC-181. It describes Autocarb systems for control of carbon potential and gives various applications. The folder also includes installation photos, illustrations of new control instruments, and a chart for selecting the proper system. **Write or call: Surface Combustion Corp., Dorr and Thomas Streets, Toledo 1, Ohio, for Folder SC-181.**

Pressure instruments

. . . with corrosionproof glass-fiber cases for indicating, recording, controlling, and transmitting, are described in new Specification Sheets 11-1451P-1 to 5. The sheets list construction materials, design features, performance, and operational limits. **Write or call: Fischer & Porter Co., 843 Jacksonville Road, Hatboro, Pa., for Specification Sheets 11-1451P-1 to 5.**

Mechanical shaft seals

. . . which stop gas and liquid leakage from around rotating shafts of pumps, compressors, mixers, etc., and which eliminate adjusting, repacking and other maintenance, are outlined in a new four-page bulletin. It contains typical installations, complete descriptions, and specifications for mechanical-shaft seals in a range of sizes for shaft diameters of from ¼ to 3⅛ in. The bulletin also presents details on custom-built roll-neck seals and shows the mechanical design by which roll necks are not damaged. **Write or call: Syntron Co., 1389 Lexington Avenue, Homer City Pa., for Mechanical-Shaft Seals bulletin.**

Temperature measuring-recording

. . . device records gas chromatograph column or sample inlet temperature directly on the recorder chart, as described in new Specification Sheet 752. The accessory was designed for installation on 1 mv. recorders. The sheet gives applications, ordering information, a chart, and photograph. **Write or call: Beckman Instruments, Inc., 2500 Fullerton Road, Fullerton, Calif., for Specification Sheet 752.**

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IN 63 FOOT LENGTHS
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LINE PIPE
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Save on Field Construction Costs
36% to 50% less field welding
There are less welds per mile of pipe when you specify Master 63 foot length line pipe instead of 40 foot lengths.
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HOMCO and **ASSOCIATED** have joined forces to furnish the oil industry an unmatched and unequalled group of services. Whatever your needs in the oil fields may be, you are assured of the same outstanding service that has for 31 years made HOMCO famous for Directional Drilling, Fishing and Cutting, Oil Field Supplies and Electrical Well Service—plus—the resources of the world's largest oil tool rental service, Associated Oil Field Rentals.

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DIRECTIONAL DRILLING • FISHING & CUTTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE • RENTAL TOOLS

This Man Can Help You Get More Efficiency From Plant Equipment

Efficiency is what you want from your plant equipment, and the Dowell engineer can help you get it. Plants in every major industry—for example, oil refining, chemical, public utility, steel and paper—are getting productive results from *economical* chemical cleaning by Dowell.

To remove scale and sludge from your process equipment, boilers, tanks and piping, Dowell engineers provide knowledge and tools you can get from no other chemical cleaning service. You get cleaning knowledge gained from developing and working with the rigorous cleaning standards of the missile program at Cape Canaveral. You get new tools and chemicals from a continuous research program. For example, Dowell recently introduced a new high-velocity jetting device for cleaning tube bundles.

And you get 20 years' worth of experience in all types of industry from Maine to California. Plant operators find it pays to call Dowell on even the smallest job. But they also know that Dowell has the manpower and equipment to clean the largest and most complex systems.

The Dowell engineer takes pride in doing your job so well that you will continue to call him for your cleaning work. This desire to do your job well covers every facet of service—from seeing that you get solvents exactly as specified, to supervising Dowell's full-time safety program. Every precaution is used to protect your personnel and equipment.

Prompt service and detailed information is yours from any of the 165 Dowell stations and offices. Get more efficiency—economically—with the help of the largest, the oldest, the most experienced chemical cleaning service—Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

EQUIPMENT MEN

Odex announces four changes

. . . involving its marketing facilities. Berkeley Dynamics was named Odex Engineering Co.'s West Coast sales and service representative.

Ben Franklin, former sales engineer at the Odessa, Tex., office, is being moved to Gretna, La., where he'll take over as division manager for the southern part of the state. Tom Sherril, another sales engineer in the Odessa area, was promoted to manager over the Oklahoma division. He'll operate at Oklahoma City.

Bob Dozier, formerly with Sivalls Tank Co. and J&J Steel & Supply Co., has joined the Odessa staff as a sales engineer.

Keenan Pipe made distributor

. . . of National Tube oil-country tubular products, announces Albert J. Lasken, Jr., vice president of Keenan Pipe & Supply Co.'s Oil & Industrial Division. Keenan Pipe has been a distributor of National Tube's line pipe, merchant pipe, steel and condenser tubes, and alloy and stainless pipe for more than 20 years.

Jack G. Howe named plant

. . . representative of National Supply Co.'s Houston facility, where he'll be in charge of liaison between the plant and field organization in the sale of wellhead equipment.

Howe started at the Houston plant 18 years ago. Before his appointment, he was engaged in wellhead sales work for National's Corpus Christi, Tex., district.

Tex-Tube appoints Kearney

. . . manager of sales. He replaces William S. Beall, who was named vice president. R. W. Kearney, who has been with Tex-Tube, Inc., since 1952, was formerly with Magnolia Petroleum Co.

R. W. Kearney

Robert R. Reed to head

. . . Lone Star Steel Co.'s Gulf Coast region, according to Walter T. Moreland, vice president of sales. Reed joined Lone Star in 1954. He will continue to work out of the company's Houston office.

J. C. Williams, Jr. is elected

. . . president of the Association of Oilwell Servicing Contractors, replacing J. F. McAdams. Williams, who served as first vice president last year, has been an active member since AOSC was founded in 1956.

Other officers named are Leo Kent, first vice president; Jimmy W. Wilkins, second vice president; and Barney Foster, treasurer.

New directors added to the group's 30-member board include Ralph Clarke, Ike Dolan, Bill Clayton, and R. E. Baggett.

The association has 18 chapters in eight southwestern states and a membership of nearly 300.

Seismograph Service completes

. . . a 3-day indoctrination meeting for 25 key personnel of the firm's newly established Birdwell Division. The new division, formerly Birdwell, Inc., was purchased by Seismograph Service Corp. earlier this year.

The meeting, the first involving personnel from various Birdwell districts, was held in an effort to outline the coordination of services between the two groups. G. H. Westby, SSC president, said that while the operations of Birdwell will continue for the present as a separate division, many of its staff services and responsibilities will be taken over by SSC.

Lauducci made chief engineer

. . . by Orbit Valve Co., according to D. W. Blevans, vice president in charge of engineering. Lauducci was previously with Midwestern Instruments, Inc., in Tulsa, as coordinator of planning for all engineering projects. He served as the company's coordinator with Consolidated Machine Tool Co. in the construction of the world's largest mill.

R. A. Lauducci

Robert E. Hauser appointed

. . . district sales engineer to serve the Mid-Continent area for Wilson-Snyder Works of U.S. Steel Corp.'s Oil Well Supply Division. Hauser will headquarter in Tulsa. The new appointee joined Wilson-Snyder in 1951 and, after serving in various capacities at the Braddock, Pa., factory, became an application and service engineer in 1954.

Donald F. Ball is appointed

. . . manager of Ford Division's heavy-truck sales department, reports Walter J. Cooper, general sales manager of the division. Ball succeeds John F. McLean, Jr., who was named executive assistant to the regional sales manager at Ford's midwestern regional sales office in Chicago.

Ball formerly was supervisor of the heavy-truck sales and engineering section at the division's general office

SALES PLANS for both current and upcoming new products were laid at Oil Center Tool Co. recently during the annual sales meeting attended by all division managers. Al Wolff, seated, O-C-T president, presided at the 3-day meeting with Charlie Jones, extreme left, vice president and sales manager. From left are Jones; Jim J. Humphries, city salesman, Dallas; D. L. Tanner, South Louisana division manager (Shreveport); Walter Burke, South Texcs division manager (Corpus Christi); Jack Simms, Rocky Mountain division manager (Casper); A. M. Taylor, Oklahoma division manager (Oklahoma City); H. C. Stewart, North Louisiana division manager (Shreveport); William Delaney, Four Corners division manager (Farmington); A. C. West, Western regional manager (Houston); M. E. Hunter, Eastern regional manager (Houston); Harry McDow, West Texas division manager (Odessa); and George Berg, Houston district manager (Houston).

in Dearborn, Mich. He started with the company 5 years ago as a truck-sales engineer with the Great Lakes regional sales office. He joined the heavy-truck sales department when it was formed in April 1957, and became supervisor of the sales-engineering section in November 1957.

Willis P. Baker is appointed

... division sales manager for the northeast division of Schlumberger Well Surveying Corp. After joining the company in 1947, Baker served as a field engineer and district manager in the Illinois basin. In his new post, he will locate in Schlumberger's Evansville, Ind., office.

Jack R. Martin is promoted

J. R. Martin

... sales manager of Midwestern Engine & Equipment Co., Inc.'s, Tulsa division, according to Armon H. Bost, president. Martin started with Midwestern in June 1957. He was previously employed by Standard Industries, Inc., and Eugene Dietzen Co.

Charles Caldwell joins Reed

... Roller Bit Co. as regional representative for the Houston Gulf Coast area. He previously did special sales work for Mid-Continent Supply Co. and was president of Harrisburg Sales & Service Co. Caldwell has worked in Kansas, Oklahoma, and Texas.

Wheaton Brass Works names

... three new distributors on the West Coast to handle the New Jersey firm's liquid-handling equipment. Representatives are R. H. Alexander Co., Los Angeles; Myrick Equipment Co., San Francisco; and Hallidie Machinery Co., Inc., Seattle.

Billy E. Smith is appointed

... district manager of Neilsen Pump Works of U.S. Steel's Oil Well Supply Division at Long Beach, Calif. He was employed in 1947 at Coalinga, Calif., and was appointed field representative at Bakersfield, Calif., in 1950. Three years later he was transferred to Huntington Beach, Calif., and in 1956 to Long Beach.

R. D. Cocanower transferred

R. D. Cocanower

... to Western Co.'s Midland Division sales staff as a sales engineer. He most recently was a research associate at the company's major research facilities in Dallas.

Cocanower has been with Western for 12 years, the past 8 in the research department. He gained recognition for his invention of Rockett J-II, carrot - free jet - perforating charge.

Licensing plans completed

... between American Iron & Machine Works Co., Oklahoma City, and AMF International Co., of Geneva, Switzerland, both subsidiaries of American Machine & Foundry Co., and Metallurgique de Domine Par Naintre (Vienne) of France. The arrangement calls for the French concern to manufacture American Iron's patented tool joints and drill collars, and to market them in France and in other areas throughout the world.

Marshall D. Payn is appointed

... Rocky Mountain district manager for OPW Corp. Payn, who has been a sales engineer for OPW since 1957, will locate in Denver.

Kenneth Harlow is named

... sales engineer at Jetwell, Inc.'s Great Bend, Kans., station. He was employed in the electrical well-servicing department of Halliburton Oil Well Cementing Co. before joining Jetwell at Winfield, Kans., last year.

Hardy-Griffin gets new

... vice president and general manager—Joe Safford, and opens a new sales and service office in Farmington, N. M., under the supervision of Hal D. Hughes.

Joe Safford

Hal D. Hughes

Safford was promoted from general manager and sales manager of Hardy-Griffin Engineering Corp. Previously he was a sales engineer for Mannesmann Tube Co., Ltd., of Sault Ste. Marie, Ontario, Canada. He had also been with Atlas Pipe, Inc., Hydril Co., and Stanolind Oil & Gas Co.'s Tulsa research lab.

Hughes has had more than 10 years' experience in oil-field sales and service. Hardy-Griffin is a division of Atlas Pipe, Inc.

Baash-Ross adds two

... sales and service engineers, announces Hal Messinger, general sales manager.

Wallace L. Reed has been named area sales engineer. He'll work out of the Houston office and will cover the Gulf Coast area. Reed had been with Oilwell Supply Division of U.S. Steel Corp. for 9 years.

William F. (Bill) Krause, Jr., was appointed area sales engineer at the Oklahoma City office. He has worked for Magnet Cove Barium Corp., Parkersburg Rig & Reel Co., McEvoy Co., and International Petroleum Co., Ltd.

Baash-Ross, a division of Joy Mfg. Co., also announces the appointment of Wilbur F. Lane in the Odessa sales office.

John R. Burkett is appointed

... general sales manager for American Cyanamid Co.'s explosives and mining chemicals department, announces Hugh Puckett, sales director of the Organic Chemicals Division. Burkett will direct commercial operations of the department's newly formed regional sales organization and will make his headquarters in New York.

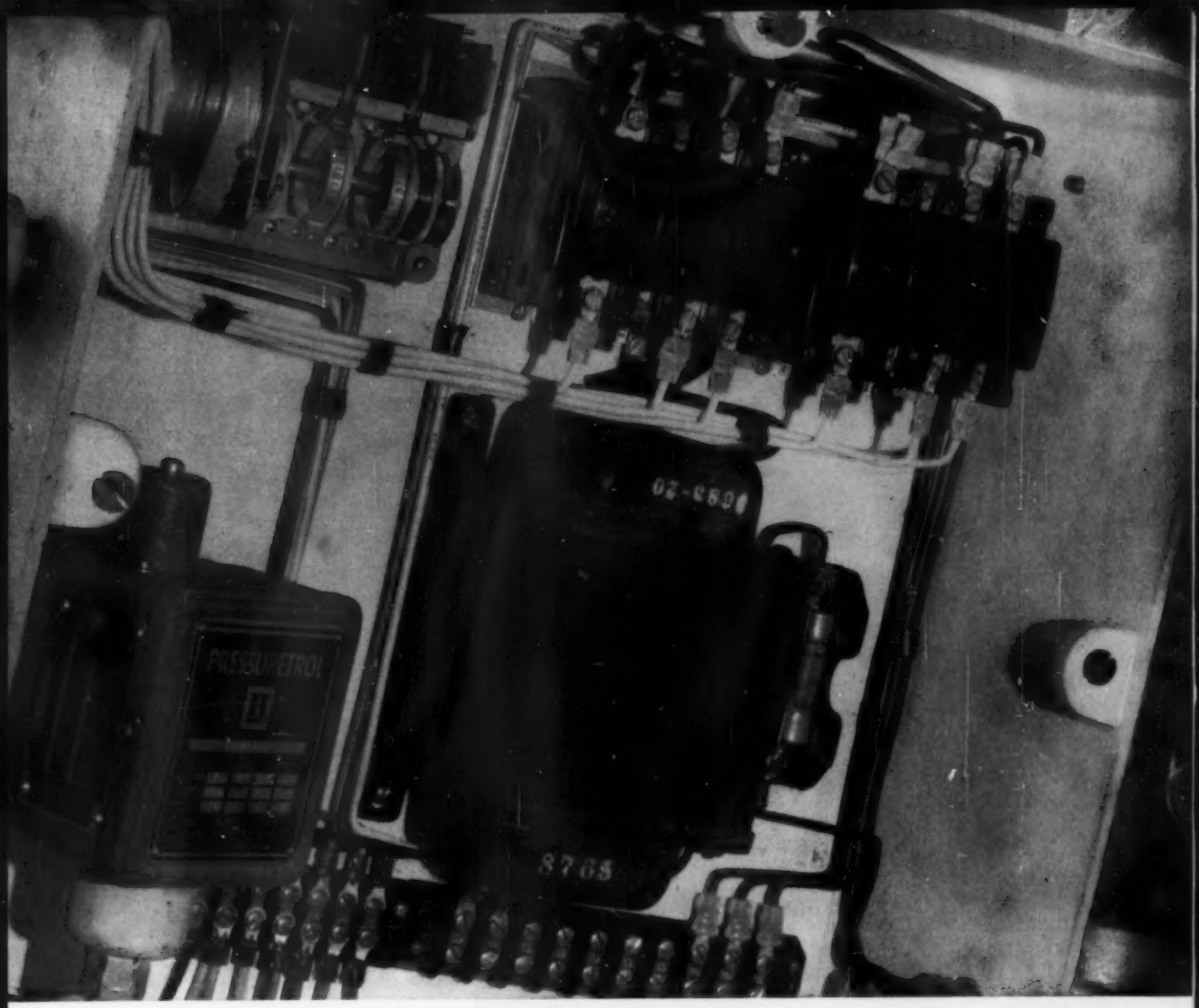
He joined Cyanamid in 1935 and has served as assistant manager of the dyes department, business manager for dyes and pigments of North American Cyanamid, Ltd. Montreal, and assistant manager of the explosives and mining chemicals department.

E. C. Farrar was named eastern regional manager and O. R. Brown, western regional manager. They will report to Burkett. Farrar will locate in Latrobe, Pa., while Brown will have offices in Salt Lake City, Utah. Farrar and Brown each started with Cyanamid in 1935.

Parkersburg's key personnel

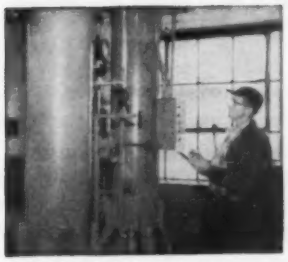
... including nearly 100 executives and sales representatives attended the firm's international sales meeting and promotion clinic held recently at Houston.

The 2-day Parkersburg Rig & Reel Co. meeting included films, demonstrations, contests, prizes, and a specially written theme song. There were also talks on oil-producing equipment, cold separation, developments in hydrocarbon-adsorption units, and improvements in glycol units.



For "set it and forget it" gas drying—

Come to Kemp



Kemp Dryer protects instrument lines at −25° for Quaker State's Farmer's Valley, Pa. plant. Fully automatic operation saves time and manpower, yet provides dependable service on a 24 hour basis.

Here's the nerve center of every Kemp Fully Automatic Gas Drying Unit. Drying process gasses and inerts . . . air for pneumatic instruments and tools . . . liquids . . . for pressurizing anhydrous liquids . . . this panel controls the Kemp Dryer surely and safely. Once timed to meet your program, it provides efficient drying on a continuous basis, without worry or excessive maintenance.

Note the precision with which even the wiring is connected. It's typical of the thorough workmanship going into every component of the Kemp Dryer. Kemp Dryers are built with care; built to last and perform year after year with dependability resulting from a quarter century's experience.

Whether your operation calls for a completely automatic Kemp Dryer, a semi-automatic model, or a simple, manually operated unit, there's a model and capacity to meet your needs. Kemp Field Engineers will gladly study your problem and make complete recommendations, even down to the proper desiccant (we select from over 20) to do your job best.

Call in your Kemp Representative when you plan a new installation or wish to up-date an old one. He'll give you full information. Or write direct and ask for Bulletin D-102: THE C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.

Convection Dryers

Inert Gas Generators

KEMP
OF BALTIMORE

Nitrogen Generators

Oriad Dryers

Midwestern-Walco "24's" months of tight schedule on Texas -

Midwestern-Walco Contractors, St. Petersburg, Fla., putting in the 678-mile midsection of the gulf-skirting Texas-Florida natural gas line, is pushing a hazardous venture toward a successful conclusion. Fastest progress is being made on Supt. Bill Wilhite's No. 1 spread, where king-sized capacity and precision control of 11 planet-powered International TD-24 crawlers are cutting more than two months off contract completion time!

This $163,757,300 Houston Corp. project, including 2,654 miles of trunk lines and laterals, between southeastern Texas and Miami, is scheduled to have main lines operating by June 1. Result: Low cost fuel will cut Florida electric costs drastically and make possible tremendous new industrial expansion.

"24's" give combination of advantages

On any big-inch pipeline, the new International Superior TD-24 sideboom produces a tremendous 130,000-lb. lift—plus a combination of load-control, traction, and flotation advantages found in no other pipelayer.

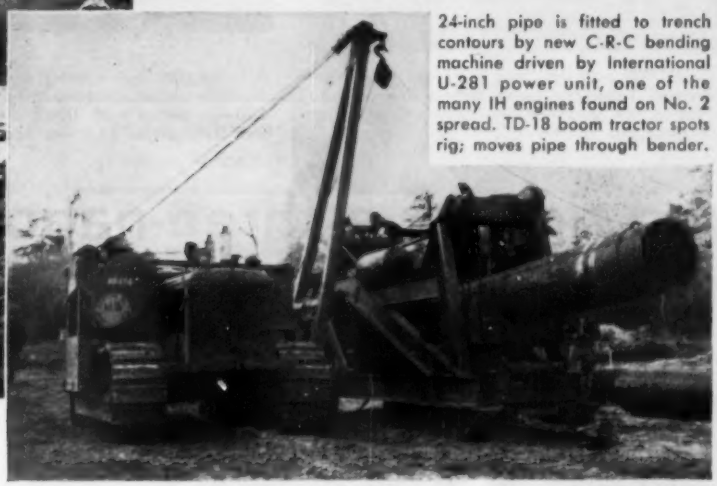
Turn smoothly, fully loaded, with exclusive, years-proved TD-24 Planet Power steering that lets you feed full-time "live" power to both tracks. Operate without production-limiting "dead track drag" on all turns.

Positive control—"stay-on-top" flotation!

Exclusive, on-the-go TD-24 Hi-Lo power shifting gives stall-preventing time-saving matching of speed to load. And exclusive finger-tip hydraulic braking and foot

Moving ahead 1½ miles daily, these TD-24 sidebooms team up wrapping and lowering-in 24-in. pipe on the Midwestern Walco No. 1 spread. Nine other "24's" are used to ram-rod this pace-setting spread.

TD-24's clear up to 12,000 feet daily through swamps. Trees are used to rip-rap the right of way to help Supt. Denver Franklin achieve a fast finish with his No. 2 spread.



24-inch pipe is fitted to trench contours by new C-R-C bending machine driven by International U-281 power unit, one of the many IH engines found on No. 2 spread. TD-18 boom tractor spots rig; moves pipe through bender.

ahead
Florida gas line

Clean-up operations on No. 2 spread progresses 3 miles daily with 75-hp International backfiller handling final phase of the job. Operating ease aids backfilling capacity!

decelerator regulate TD-24 motion for added pipe-handling precision control.

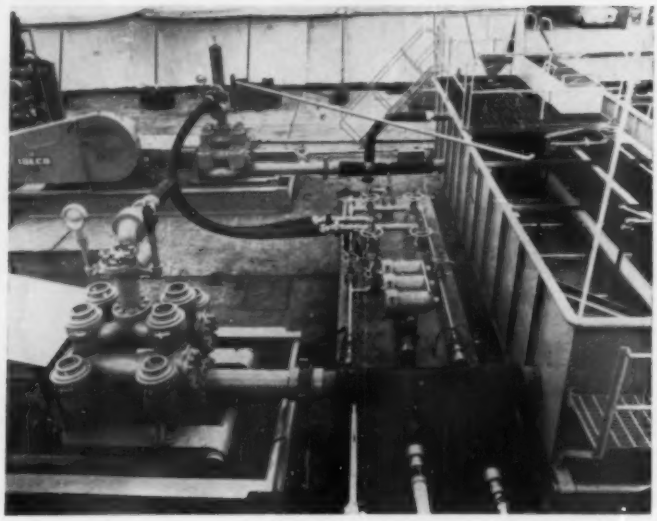
Stay on top of soft footing with TD-24 sideboom full-flotation traction-weight balanced over center track roller, and up to 18% less poundage psi on its tracks than other boom tractors.

See why exclusive advantages of TD-24 boom-and-blade crawlers increase pipe-laying capacity, substantially—over all other king-sized rigs. Compare the new TD-24, and three other bonus-powered International Superior sidebooms for top pipe-handling value in their size classes. Call your International Superior Distributor for an on-the-line demonstration of the boom, blade, and tow equipment you need.

INTERNATIONAL HARVESTER

INTERNATIONAL®
SUPERIOR

IRAQ-BOUND portable rigs get final inspection at English assembly point before delivery to Drilling & Exploration, Inc. The drilling rigs were designed in the U.S.



ALL MAJOR mud-system components on new Iraq rigs are unitized on five skids. Skid-mounted units shown are: Manifolding, center; 600-hp. pump with three diesel engines, foreground; 450-hp. pump with two diesel engines, background; mud tanks, right.

Iraq rigs have three-nation origin

OILFIELD-EQUIPMENT manufacturing companies of three countries had a part in the assembly of two new highly mobile rotary rigs which Drilling & Exploration, Ltd., of London, is putting into operation in Iraq.

The rigs are specially built Ideco-Woodfield Dual-Rambler assemblies of American design and English and French manufacture. English and French equipment was supplied under a license agreement with Ideco, Inc.

Assemblies are complete packages, including drilling equipment, cementing facilities, trucks and other vehicles, field office buildings, and family-type living quarters. Each is rated for drilling to 8,500 ft. with 4½-in. drill pipe.

Actual assembly of the equipment was by Woodfield Rochester, Ltd., of Reading, England. Two of the mud pumps were manufactured in Nantes, France, by Batignolles-Chatillon. Two other pumps came from Ideco's plant at Beaumont, Tex. The English company made the machinery trailers, masts, draw works, and other rig components.

Drilling & Exploration, Ltd., a wholly owned subsidiary of Drilling & Exploration Co., Inc., Dallas, is using the assemblies in an extensive drilling program for Iraq Petroleum Co., Ltd.

Drilling equipment on each rig includes a Hydrair 525 hoist, powered through compound by two 235-hp. Cummins diesel engines, a 600-hp. Ideco Mud-Master pump, powered by three chain-compounded Cummins NRTO-6 diesel engines, and a 450-hp. pump with two engines. Each uses a 105-ft. Kwik-Lift mast with permanently strung traveling components.

Drillers ask boost in depletion provision

DIRECTORS of the American Association of Oilwell Drilling Contractors have called upon Congress to increase the 27½% depletion provision on oil and gas production.

A resolution passed at a recent AAODC meeting in Lafayette, La., stated such an increase would be "in the interest of maintaining an adequate oil and gas supply for all national, industrial, civilian, and military needs."

The resolution asked an increase to "a level which will encourage a sufficient rate of exploratory drilling to achieve this necessary producing ability.

"An insufficient number of exploratory tests has been drilled in the United States during recent years to find enough new oil and gas supplies to maintain the nation's unproduced reserves," the resolution pointed out.

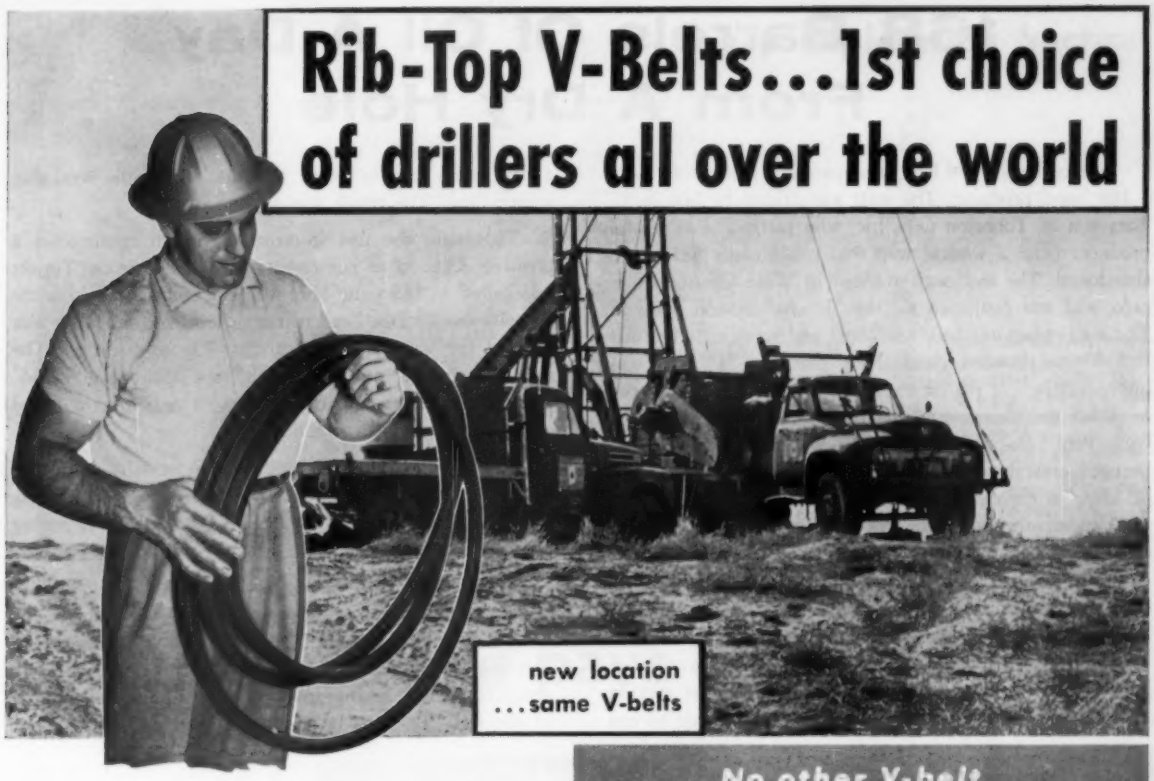
It blamed increased costs and inadequate funds for the decrease in number of wells drilled annually since 1956, and the drop in average number of operating rigs during 1958 to a 15-year low.

Another resolution passed by the directors urges the President's Cabinet Committee to formulate a definite oil-import program which will include provisions to limit imports of both crude-oil and refined products to their 1954 ratio to United States crude-oil production.

Deep drilling job goes to Williams

R. E. Williams Drilling Co. has taken a 10,000-ft. drilling job in southwestern Marion County, South Mississippi. Contract is with James Biglane Trust and S. B. Laub, of Natchez, for 1 Thomas, in 3-1n-13e. Location is 2 miles east of Dexter field, and about the same distance southwest of Hub field. It is a Washita-Fredericksburg test.

Rib-Top V-Belts...1st choice of drillers all over the world



Gates Rib-Tops are the ONLY V-belts designed specifically for mud pumps. Specialized design and construction provide longer life, minimize down-time, and thus lower belt replacement costs.

Yet Rib-Tops cost no more than ordinary belts of comparable ratings.

Both Standard and Super Rib-Tops are available at your oil field supply house.

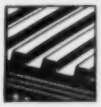
For Your Tougher Drives Use *Super* Rib-Tops!

With 40% greater horsepower capacity, Super Rib-Tops handle overloads easily. Fewer belts and narrower sheaves solve space and weight problems.

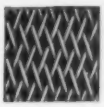
The Gates Rubber Company
Denver, Colorado

The Mark of Gates *Specialized* Research

No other V-belt has ALL these advantages

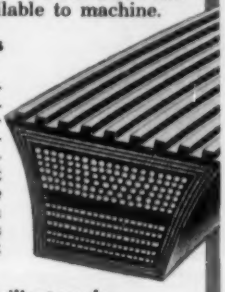


1. Stabilizing ribbed tops (U.S. Pat. 2548135) are exclusive with Gates. They dampen vibration, protect top of belt from damage, keep belt running smoothly over idler-equipped mud pump drives with no side whip.



2. Flex-Weave Cover (U.S. Pat. 2519590) A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer... increases belt life ... more power available to machine.

3. Concave sidewalls (U.S. Pat. 1813698) Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt ... longer belt life.



4. Tougher, more resilient cords are able to absorb the severe pulsations of mud pumps; easily handle peak loads.

TPA393

Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

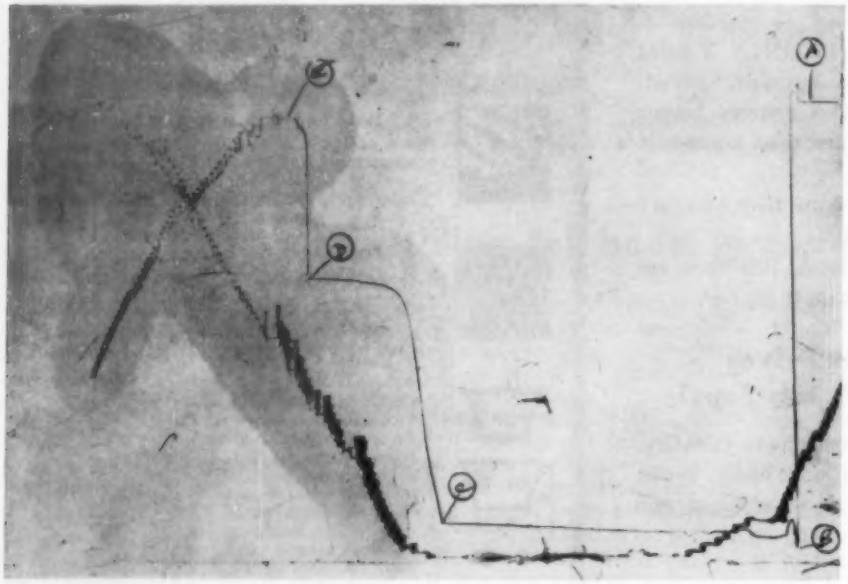
168 Barrels Of Oil A Day From A Dry Hole

This is the story of how an apparent dry hole was made a 168 bopd producer. The well was drilled by Mr. A. C. Torgeson of Torgeson Oils, Inc. who realized a successful producer from a wildcat well that could easily have been abandoned. The well was spudded in Weld County, Colorado, and was projected for the "J" sand around 6900 ft. The sand, when reached, was cored and an electric log was run. These revealed conclusively that the "J" sand was unproductive . . . that it contained only water. Had it not been for the alertness of the consulting geologist on the well, Paul "Skipper" Keller, the well would have been plugged and abandoned. Keller, however, had noticed an oil show in the cuttings from the "D" sand approximately 100 feet up the hole. The "D" sand was generally unproductive in the area and a thorough study of all available evidence indicated that it probably would be unproductive in this well even though there was a show in the cuttings. Normally a well of this type would have been abandoned immediately, but Mr. Keller was reluctant to do this in spite of the seemingly overwhelming odds against making a successful producer. The decision was then made to run a drill stem test in order to evaluate all the available information. The result was a producer!!!

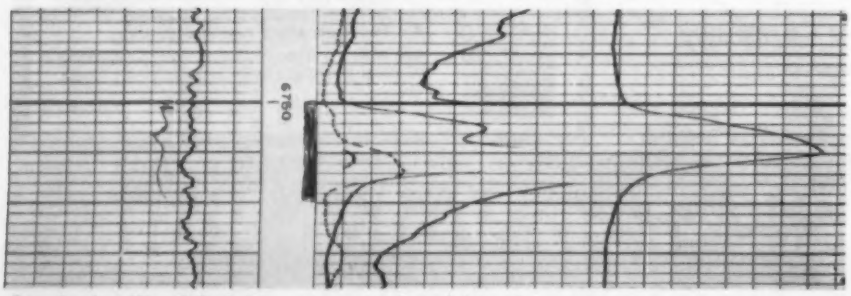
To obtain the test information which resulted in a positive decision to complete the well, Johnston Testers was called in from the Fort Morgan office and a straddle test was run. On the basis of the drill stem test, casing was set and the well perforated from 6758 to 6764 ft. The initial flow of the well was 168 bopd through a 30/64" choke. No well stimulation treatment was required and a dry hole became a producer.

This is an excellent example of the necessity of gathering and evaluating all the data possible before setting casing on a well that might be dry, or before abandoning a possible producer.

This well clearly demonstrates that it is unwise to discount any possible pay or write-off any well prematurely. It also demonstrates that Drill Stem Testing pays off in handsome dividends. The cost of a drill stem test is very small compared to the investment made in the drilling of the well. Test—to be absolutely sure.

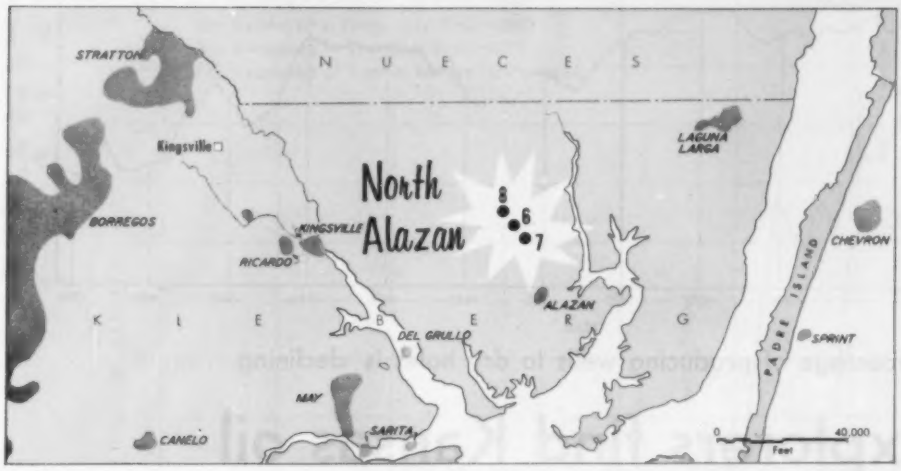


Drill Stem Test chart for the Torgeson State No. 1. Tool was open for two hours with forty-five min. shut-in. Gas to surface in 18 min. (800,000 cu. ft.) and a good blow was observed. 550 ft. of oil and 270 ft. of oil and gas cut mud were recovered. No water was present. Initial flow (B) was 108 psi and final flow (C) was 291 psi. Final shut-in pressure (D) was 2221 psi.



Log showing SP and Resistivity curves at perforated interval.

JOHNSTON
DRILL STEM TESTING
TESTERS



AN IMPORTANT new oil and gas field is shaping up on Kleberg County's famous King Ranch in South Texas. Two wells have uncovered five separate pay zones in the Frio formation, and a triple completion is on the way.

Humble hits five pays in King Ranch

BY FRANK J. GARDNER

SOMETHING big is happening in the cowboy kingdom of Kleberg County, Texas. In the El Alazan pasture of King Ranch, Humble Oil & Refining Co. has lassoed three fine oil wells in a one-two-three punch. And the new North Alazan field, first discovered last December, may soon be branded a major find.

Five pays in two wells . . . The discovery well, Humble 6 King Ranch Alazan, came in quietly enough on December 9, 1958, as a dual producer. From Frio sands designated as the H-08 and H-21 zones, it made gas-condensate and oil completions, respectively. The H-08, perforated at 7,080-90 ft., recorded an absolute open flow of 11,500 M.c.f. gas per day plus 58.4°-gravity condensate at a gas-liquid ratio of 69,930-1; this was the upper tubing phase. The H-21, at 7,220-30 ft., flowed 281 bbl. of 39.4° oil on ⅝-in. choke, from the lower tubing. Total depth of the well was 8,938 ft.

The real news, however, is the second well, Humble 7 King Ranch Alazan, about a mile southeast of the discovery. It is closed in right now, awaiting Railroad Commission approval of a triple oil completion. Not only did it confirm the oil strike in the H-21 sand at 7,232-40 ft., but it added two new and deeper oil sands to the field, the H-28 Frio at 7,280-86 ft., and the H-53 at 7,535-40 ft. The well was carried to total depth at 9,020 ft. No mention was made of the H-08 gas-condensate sand in this second success, but it must be assumed that it was potentially productive.

Flow tests on the 7 Alazan are impressive enough to indicate that we may be witnessing the birth of another Seeligson or Borregos field here. From the lowermost H-53 pay, flow of 188 bbl. daily was reported; gravity of the oil was 36.4°. From the H-28, the flow was 164 bbl. daily, with gravity at 43.7°. The discovery sand, H-21, made only 86 bbl. All tests were on ⅛-in. choke.

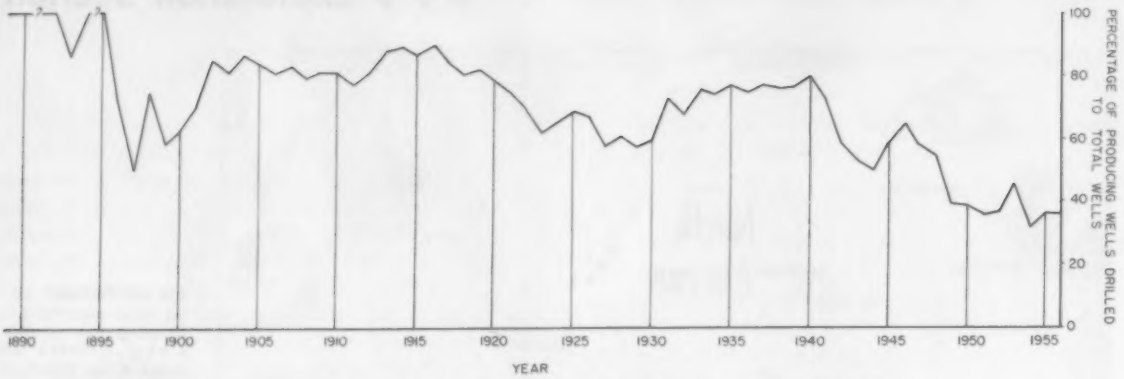
Now, Humble has moved in completion rig at the third North Alazan well, the 8 King Ranch Alazan, standing at total depth of 9,008 ft. No dope is yet available on plans for its completion, but doubtless we'll see another multiple well here; it lies about a mile northwest of the 6 Alazan discovery. When it's finished, the field will be ruler-straight over a distance of 11,806 ft. Location has been staked for the fourth well, the 9 King Ranch Alazan, southeast of No. 7. This extends the activity another mile.

Enhance the fabulous Frio . . . Here is just one more example of the undiscovered multipay fields locked within the sparsely drilled mesquite bowl of South Texas. A one-pay field in this region is a rarity. The "fabulous Frio" is noted for productive zones in bunches — 53 at Seeligson field, 35 at Borregos, just for a sample. Those are prorated oil zones only; gas is not included.

The North Alazan discovery emphasizes the need for deeper exploration throughout South Texas. The large land ownerships in the coastal ranchlands of this part of the state are blanketed with leases carrying five-figure acreage tags, and vast areas lie untested. These are future wildcat targets that can be expected to yield to the bit eventually, for few spots in the United States are more likely to hold big oil. This cattle country embraces most of Kleberg, eastern Brooks, northern Hidalgo, all of Kenedy, and large parts of Willacy and Cameron counties. It lies astride the deepest part of the great Rio Grande embayment, near the center of the Southwestern Salt basin.

Cattle are still the rancher's first interest here, and they always will be. But it's often been said that no steer is so fat as the one that rubs his ribs on a christmas tree. We venture to predict that the critters in Alazan pasture are in for a lot of new poundage in the months ahead.

FIG. 1 PART 1



Although the percentage of producing wells to dry holes is declining . . .

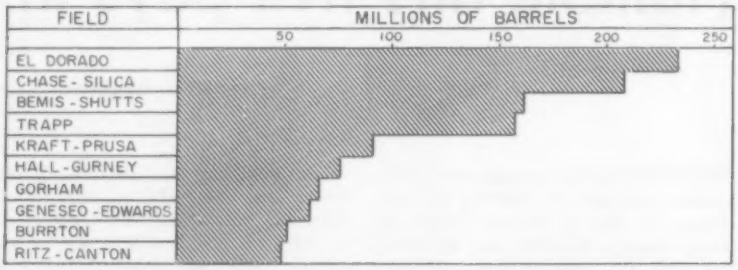
Alert explorers find Kansas oil

BY DANIEL F. MERRIAM AND
EDWIN D. GOEBEL
State Geological Survey of Kansas

EACH SUCCEEDING YEAR petroleum is more difficult to find in the United States, although more and deeper tests are drilled and the latest scientific devices are used. Kansas is no exception. For more than a decade, Kansas—supplying the country with about 5% of its petroleum—has ranked fifth among leading oil-producing states. To maintain this productivity through the years, operators in the state have continued energetic exploration and exploitation programs.

In evaluating these programs questions most often asked are: Which zones are most productive? Where are the best prospects yet to be found? How many possible objectives are likely to be encountered? What are the chances of finding a 1-million-barrel field? 10 million? 100 million? How?

In many realms of scientific endeavor and especially the earth sciences, the answers may be found by looking back to profit from experience. Or, to twist an old geologic axiom, the past may be the key to the future.



NINE FIELDS IN KANSAS produced more than 50,000,000 bbl. of oil by the end of 1957, and a tenth passed the mark in 1958. Fig. 2.

TABLE 1—TOTAL OIL AND GAS PRODUCTION IN KANSAS SINCE 1938

Year	Total oil production (bbl.)	Total gas production (billion cu. ft.)	New fields			Revived		Total wells drilled
			Oil	Gas	Both	oil	gas	
1957	124,054,043	*580.7	149	21	5	4	..	6,578
1956	124,467,713	*525.9	135	35	3	5	1	8,006
1955	121,161,234	*466.2	118	25	6	10	1	7,825
1954	118,309,260	*405.8	122	22	..	2	2	8,514
1953	114,390,176	*420.6	165	22	..	3	..	5,814
1952	114,399,556	408.7	157	10	..	8	..	7,415
1951	113,912,366	407.0	147	7	..	6	..	7,108
1950	107,339,000	394.0	118	4	..	4	2	6,600
1949	100,164,092	294.0	92	4	..	..	..	5,700
1948	108,080,654	240	†74	..	..	..	..	3,700
1947	103,916,169	183	52	10	..	6	..	3,000
1946	96,624,272	143	34	3	..	..	..	2,077
1945	97,365,821	124.1	34	13	..	..	..	1,801
1944	99,853,104	134	48	6	..	..	..	1,843
1943	108,441,648	122	56	1	..	..	..	1,771
1942	98,907,986	98.5	38	4	..	..	..	1,515
1941	83,229,159	93	31	3	..	..	..	2,057
1940	64,824,721	85	24	4	..	..	..	1,867
1939	58,768,943	‡90	†38	..	..	..	..	1,458
1938	58,230,032	‡70	70	9	..	..	..	1,552

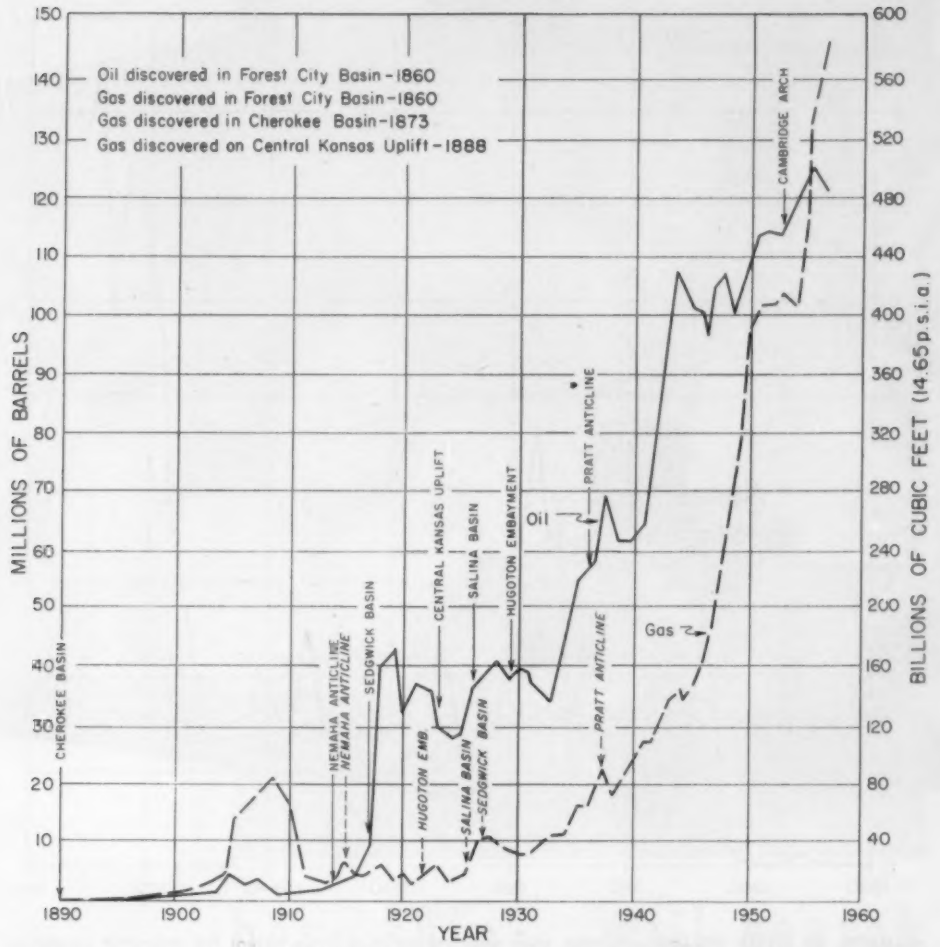
*Based on 14.65 psia. †Both oil and gas. ‡Estimated.

Although never attaining the number one ranking, Kansas has long held a leading position among states producing petroleum and has been in the top six for the last 40 years. As recently as 15 years ago, however, " . . . proved reserves discovered in Kansas . . . were only about half the amount of production. . . . " (Koester, 1944, p. 769). Even admitting that this was a bad year in finding new reserves, some foresaw the beginning of the end for the industry in Kansas. Similar statements can be heard today to the effect that all oil in Kansas has been found.

Is Oil Harder to Find?

The most obvious areas have been exploited, but is oil getting harder to find? The answer to this question ap-

This article by the authors is the second in a series on petroleum possibilities in Kansas to appear in The Oil and Gas Journal. The first, "Kansas' Structural Provinces Offer Varied Types of Traps," was printed in the April 30, 1956, issue of the Journal. Publication of this article authorized by the director, state Geological Survey of Kansas.



OIL PRODUCTION reached an all-time high in 1956, and gas production hit a record year in 1957. The total value of raw products of the petroleum industry in 1957 was about $485,000,000, about 86% of the total mineral production in the state. Graph shows year of discovery of oil or gas in various structural provinces. Fig. 3.

propriately is no and yes—oil is not more difficult to find today than before, but the discovery of oil in significant quantities is, indeed, harder. The number of new oil and gas fields discovered each year in Kansas has, with few exceptions, increased for the last 40 years (Table 1). Several factors account for the increase in the number of new fields discovered—the most obvious is that generally more wells are drilled each year, thus more chances for a strike. Other factors affecting the number of new discoveries include better completion practices, more scientific methods in locating wildcats, financial considerations, and the definition of new fields. More new fields are being found each year.

Is It a Paying Proposition?

With mounting costs each year and other considerations such as taxes, the industry as a whole seems to be hard pressed to make a profit in Kansas. In addition, the cost per barrel of oil discovered—average capital expenditure per barrel of production is about $1.70 for the nation, (Coqueron, Hammer, and Winger, 1958, p. 41)—has increased sharply in recent years, owing in part to the increased number of exploratory tests necessary to find additional petroleum reserves.

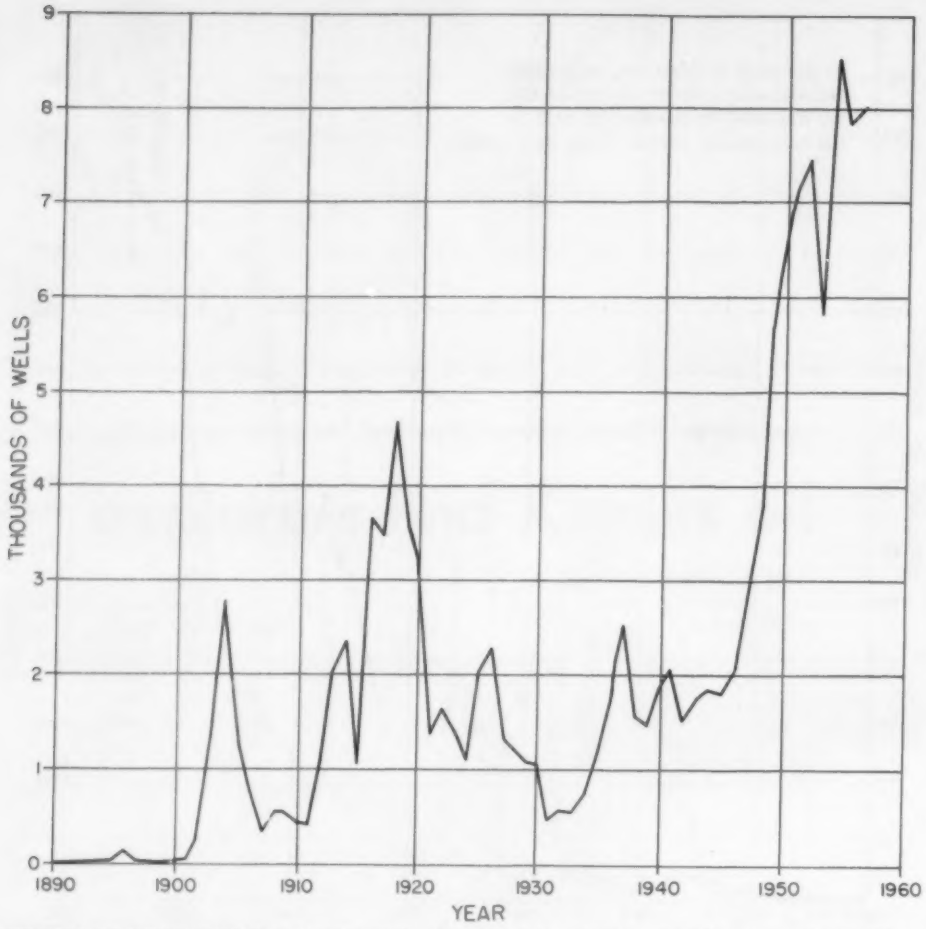
The percentage of dry holes has increased as the choice prospects gradually dwindle (Fig. 1). In the late 1880's and early 1890's almost every well drilled in Kansas was a producer; however, since that time the percentage of producers to total wells drilled has consistently decreased except in the late thirties. Tight money during the depression limited prospecting to "sure bets" then, but since the beginning of World War II bona fide exploration has resulted in an increase in percentage of dry holes as risks again were warranted by an expanding economy.

Are the Risks Worth It?

Although many fields are found each year in Kansas, the chances of finding a big one grow slim. In 1951 the chance of opening a 1,000,000-bbl-plus field was calculated to be

TABLE 2—PRODUCTION IN SIX LEADING KANSAS FIELDS, 1957

Rank	Pool	Age (years)	County	1957 production (bbl.)
1	Bemis-Shutts	23	Ellis-Rooks	5,922,087
2	El Dorado	42	Butler	4,619,047
3	Chase-Silica	27	Rice-Barton-Stafford	4,271,122
4	Trapp	22	Russell-Barton	3,727,771
5	Hall-Gurney	27	Russell-Barton	3,542,500
6	Kraft-Prusa	21	Barton-Ellsworth	3,436,752



NUMBERS OF WELLS DRILLED in Kansas each year reflect to a large extent the economic conditions. Following the discovery of El Dorado in 1914 a flurry of drilling practically flooded the market with oil. Drilling rates have increased sharply since World War II to keep up with the expanding needs of the world. Fig. 4.

about 1 in 62/5 new discoveries (Payne, 1952, p. 1101). By 1956 only 1 in 24 newly opened fields was estimated to have reserves in excess of 1,000,000 bbl. (Williams, 1957, p. 1079).

Even though the chances of finding the "big one" are diminishing, at least 180 fields in Kansas (based on production to 1957) have produced more than 1,000,000 bbl. of oil. Of these fields about 45 have cumulative production exceeding 10,000,000 bbl. and 4 can be considered giants, having produced more than 100,000,000 bbl. The El Dorado field in Butler County is the largest, its cumulative production exceeding 232,000,000 bbl. (Fig. 2).

About 20 fields in the state produce as much as 1,000,000 bbl. annually, and in 1957 the Bemis-Shutts field produced almost 6,000,000 bbl. of oil (Table 2). It is interesting to note that of the six largest producing fields the youngest is 21 years old. Of the 1,000,000-bbl.-plus fields, only 8% have been discovered since 1950, 34% from 1940 to 1949, 33% from 1930 to 1939, and 24% were found before 1929. It should be pointed out, however, that in the case of fields discovered since 1950, proration has so limited production that few fields have been able to produce at the rate required to reach the 1,000,000 bbl. mark.

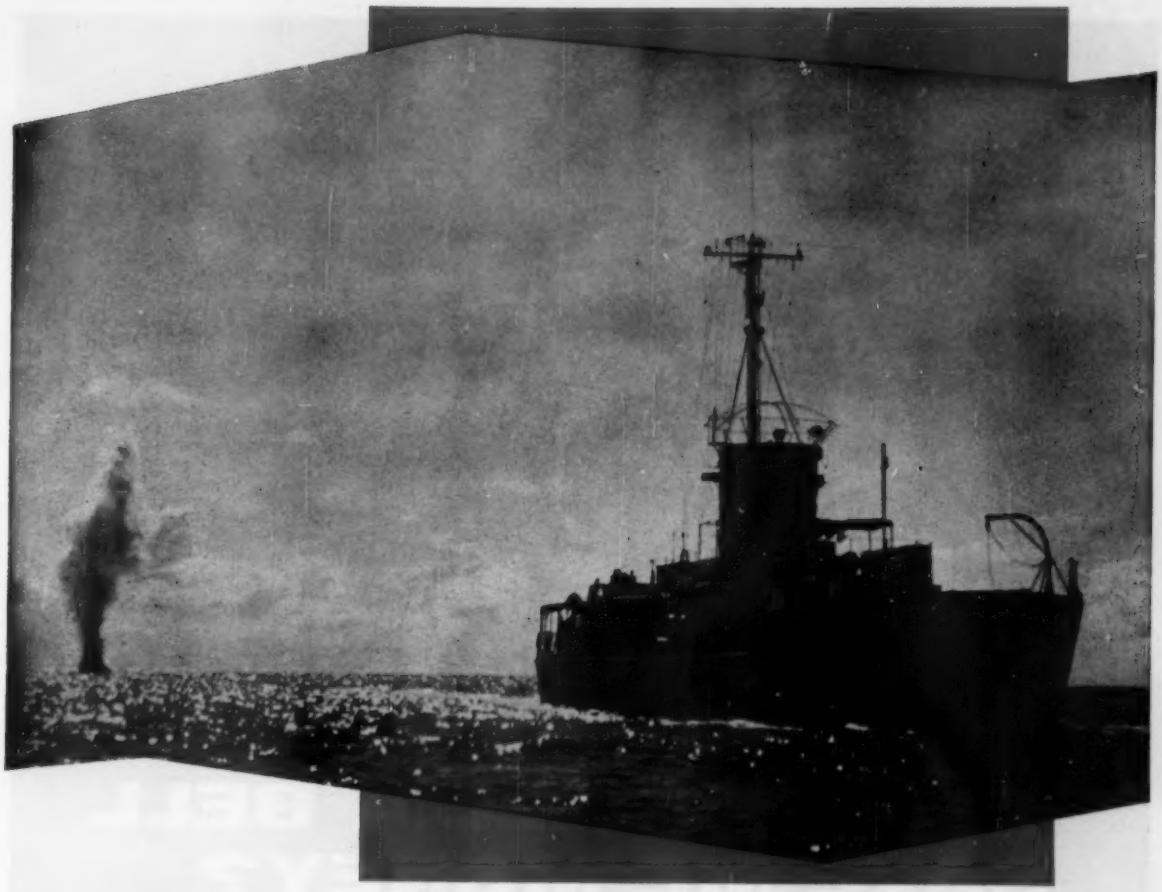
TABLE 3—CRUDE-OIL AND NATURAL-GAS RESERVES, 1946-1957

Year	Crude oil (million bbl.)	Natural gas (trillion cu. ft.)
1957	947.5	*17.6
1956	992.2	*17.6
1955	998.1	*16.3
1954	978.5	*15.8
1953	913.0	*15.8
1952	917.0	14.2
1951	791.9	13.5
1950	732.2	14.0
1949	738.4	14.5
1948	674.4	14.4
1947	562.7	14.6
1946	545.3	13.7

Based on API and AGA figures.
*Based on 14.65 psia.

Is Production Increasing in Kansas?

Production has increased almost continually since petroleum was first discovered in the state in 1860 near Paola in Miami County (Fig. 3). Oil production has more than doubled in the last 20 years, and gas production has doubled in the last 10. The daily allowable oil production per well is slightly more than 20% of what it was in 1949, and in 1957 the average daily production of crude oil, natural gasoline, and LPG was 354,461 bbl. (Williams, 1958, p. 1210). It is conservatively estimated that Kansas has produced 2,890,556,000 bbl. of oil and 5,987,800 M.M.c.f. of gas. The Hugoton gas area alone accounted for about 69% of the total Kansas yield of gas in 1957, 73% in 1956, 85% in 1955 and 1954, 92% in 1953, 90% in 1952 and 1951, and 88% in



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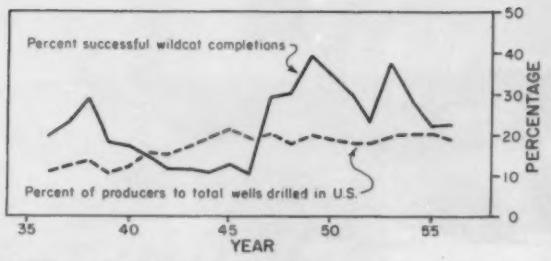
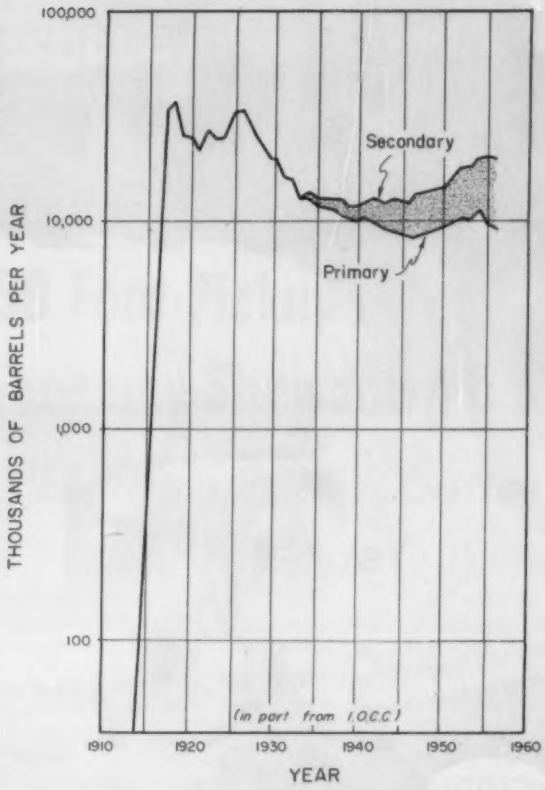


EXCEPT DURING WORLD WAR II, the percentage of successful completions in Kansas has been above that of the national average. This success has helped keep reserve estimates high. Fig. 5.



PRODUCTION in East Central Kansas by primary and secondary methods. Fig. 6.

1950. "These values indicate a continuation of a definite rise in importance of gas production within Kansas outside the limits of the important Hugoton field" (Williams, 1958, p. 1210).

Are Reserves About Depleted?

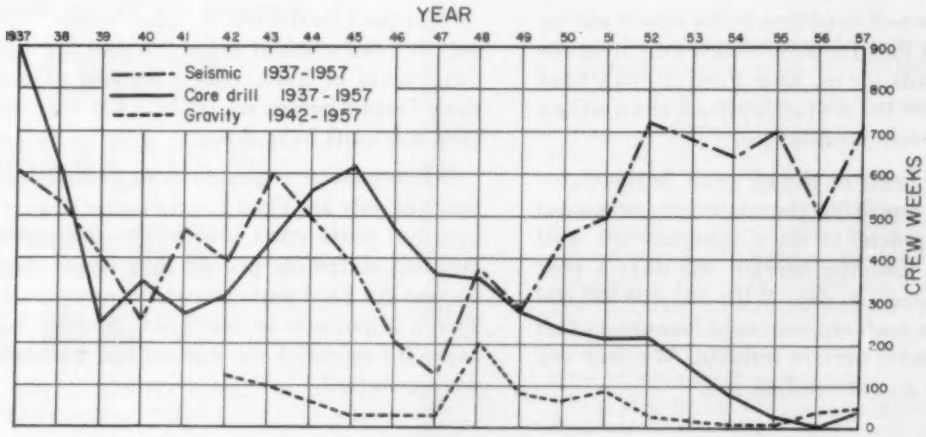
Contrary to belief, available figures would indicate that proved reserves in Kansas are nearly at an all-time high (Table 3). In a little over a decade the crude-oil reserves in the state have almost doubled despite the increased production, and gas reserves have increased more than 20%. The ratio of annual production to reserves was about 1:5.6 in 1946, increased to about 1:8.8 in 1952, and by 1957 decreased slightly to 1:7.6. The present estimated reserve (947,500,000 bbl.) is only about one-third of the total Kansas cumulative production (2,891,000,000 bbl.).

How Are Reserves Maintained?

Several reasons can be cited for the high ratio of reserves to production in Kansas. Because more wells are being drilled in the state each year (Fig. 4) and the success ratio is higher than the national average (Fig. 5), the reserves have slowly been increased in the last decade. It has been estimated by the U. S. Bureau of Mines that more than 38,200 wells are now producing in Kansas. This number is double the number of producing wells recorded in 1934. The average daily production per well for a 10-year period from 1926 to 1935 was about 6.0 bbl., from 1936 to 1945 about 9.7, from 1946 to 1955 about 9.8, and for 1956 and 1957 the average declined slightly to about 9.1 bbl.

The average depth of dry holes and producing wells drilled in Kansas has increased only slightly in the last 20 years; however, this increase is important as it was enough to open new possibilities. For example, only recently has the bit penetrated below the producing beds in the Hugoton gas area there to find new, deeper producing zones of considerable importance in an old area.

Another factor in keeping Kansas' production and reserves high is the application of secondary-recovery methods. Repressuring of oil-bearing rocks by injection of water, air, gas, or a combination of these agents has become a principal method of oil production since official sanction and status were given the practice by law in 1935. Pointing up significant secondary-recovery activities in the state, especially in the Cherokee basin and the southern part of the Forest city basin, is the fact that production has



TOTAL number of geophysical exploration crews in Kansas has increased since 1946. Fig. 7.

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Send inquiry to: P.O. Box 2687 Ford Division, Ford Motor Co. Detroit 31, Michigan

'59 Ford Pickups Win Economy Showdown U.S.A.

—average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's ½-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested—by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

The '59 Ford Sixes, *in every test*, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both low- and high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's *Economy Carburetor* is *standard at no extra cost.*

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

Read how Pete MacKellar saves $1500 per well

MACKELLAR DRILLING COMPANY

1017 CRAVENS BUILDING
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REGENT 6-5261

December 12, 1958

Wilson Manufacturing Co., Inc.
P. O. Box 1031
Wichita Falls, Texas

Gentlemen:

Three months ago we purchased a new Wilson Giant mud pump to be used on our Rig No. 5, which is a Wilson Giant Drawworks powered with two L.R.O. Waukeshas. This rig was previously equipped with a sixteen inch pump of another make.

With the new Wilson pump we have been able to run with pressures between 1100 and 1200 pounds with the same amount of vacuum on our engines that we had with our old pump running 750 to 800 pounds. With the increased pressure we have been able to cut two days and two bits from the drilling time we previously had on some 6000' wells.

With the two days savings on time, plus the fact that we have 20,000 pounds less weight to haul, has enabled us to make an estimated saving of $1500.00 per well. The pump has performed perfectly just as you represented it to us when you sold it and you can feel sure that the next pump we purchase will be a Wilson.

Very truly yours,

J. P. MacKellar

J. P. MacKellar

Write or wire collect for details of Wilson's Titan Pump offer

Wilson

WILSON MANUFACTURING COMPANY, WICHITA FALLS, TEXAS

increased from an estimated 5,000,000 bbl. in 1942 to 16,900,000 bbl. in 1956 (Goebel and others, 1958, p. 30).

An example of the importance of secondary recovery can be seen (Fig. 6) by comparing primary and secondary production in East Central Kansas (Butler, Cowley, Greenwood, and Lyon counties). In 1957 at least 210 operations were listed involving an estimated 8,500 producing wells and 4,800 input wells for injection of a repressuring medium. In 1949, only 7% of the state's total oil production was by secondary recovery, but since that time oil produced by secondary recovery has increased to almost 10% of the total.

New exploration and exploitation techniques have been developed in the last few years, which now make it possible to evaluate prospects better and to operate marginal production more efficiently. As these techniques are further developed and used, and newer methods are tried and tested, new petroleum reserves may be found.

More effort and manpower are being used to find additional reserves. It is interesting to note the increased use of the seismograph in Kansas. Almost every year since 1947 more seismic crew-weeks have been spent in the state, although other geophysical methods and core-drill activity have decreased (Fig. 7). This intensive effort has, indeed, located additional petroleum reserves that otherwise might have remained undetected at least for the present.

A lot of oil has been found in Kansas and a lot more remains waiting for the diligent seeker.

NOTE: Part 2 of this article will appear next week.

Confirmation near at Nebraska's Burr Oak

Confirmation is near at Burr Oak field in Hitchcock County on the Cambridge arch of southwestern Nebraska.

Skelly Oil Co. has run production casing to total depth of 4,136 ft. at 2 Lewis in SE SW SW 25-1n-32w. A drill-stem test in the Lansing-Kansas City Pennsylvanian at 3,912-22 ft. got 8 ft. of oil and 4 ft. of oil-cut mud in 2 hours.

New geology volume

Tulsa Geological Society Digest, Volume 26, 1958. This volume contains papers and reviews of all programs conducted at the weekly luncheons and evening meetings in Tulsa. The Digest also includes lists of various officers, awards, committee reports, and a tally of members.

TWO discoveries in eastern Schleicher County. Sinclair 2 Martin had oil in Strawn sand, gas in Strawn lime. Luling Oil & Gas Co. 1 Webster flowed oil from a Strawn section.

Texas wildcats tap Strawn

EXTREME EASTERN Schleicher County, geologically located on the southern tip of West Texas' Eastern Shelf, last week had two Pennsylvanian-Strawn wildcats working toward successful completion. Nearest production to the two tests is in the Webster and McKavett multipay gas fields.

Sinclair Oil & Gas Co. 2 Catherine Martin, in 31-8-TW&NG Survey, had oil in a Strawn sand, and below that, in Strawn limestone, had gas.

A 90-minute test in sand at 4,380-95 ft. gaged 2,300 M.c.f.d. of gas, with a spray of oil. Recovery was 275 ft. of oil and 415 ft. of oil and gas-cut mud.

The following tests were in Strawn lime: At 4,535-45 ft., gas flow was at the rate of 10,400 M.c.f. This rate increased to 12 M.M.c.f.d. at 4,545-55 ft., and at 4,555-65 ft., decreased to 6 M.M.c.f.

Location of 2 Martin is 10 miles northwest of Fort McKavett, and 4 miles northwest of gas production in Webster field. The well is on a 2,072-acre lease held by Sinclair, which is part of a 6,850-acre block northwest of Tillery field.

Oil flow in workover . . . Luling Oil & Gas Co. 1 J. W. Webster, about 3 miles northwest of Webster field, in 5-8-TW&NG Survey, was originally drilled dry to 5,206 ft.

New plugged-back depth was 4,740 ft. Operators then perforated the Strawn at 4,491-97 and 4,505-09 ft. Following treatment, with mud and regular acids, the well kicked off and flowed from 12-14 bbl. of oil an hour through 12/64-in. choke. The flow was cut 30% with salt water. Tubing pressure was 550 psi. Later it flowed 7 bbl. of oil an hour through 14/64-in. choke, being 80% oil and the balance acid water, and in a 24-hour test, it gaged 60 bbl. of oil through 16/64-in. choke, cutting only 1% water. Testing continued.

Texas' East Dougar gets second well

The second well for the recently opened East Dougar field in Newton County, Southeast Texas, opens a new pay. It is Spur Oil Co.'s 1 Holmes et al., completed at 6,997-7,000 ft. with flow of 73.26 bbl. of 45.4°-gravity oil daily through 9/64-in. choke. Spur's discovery well produces from pay at 7,060½-62 ft.

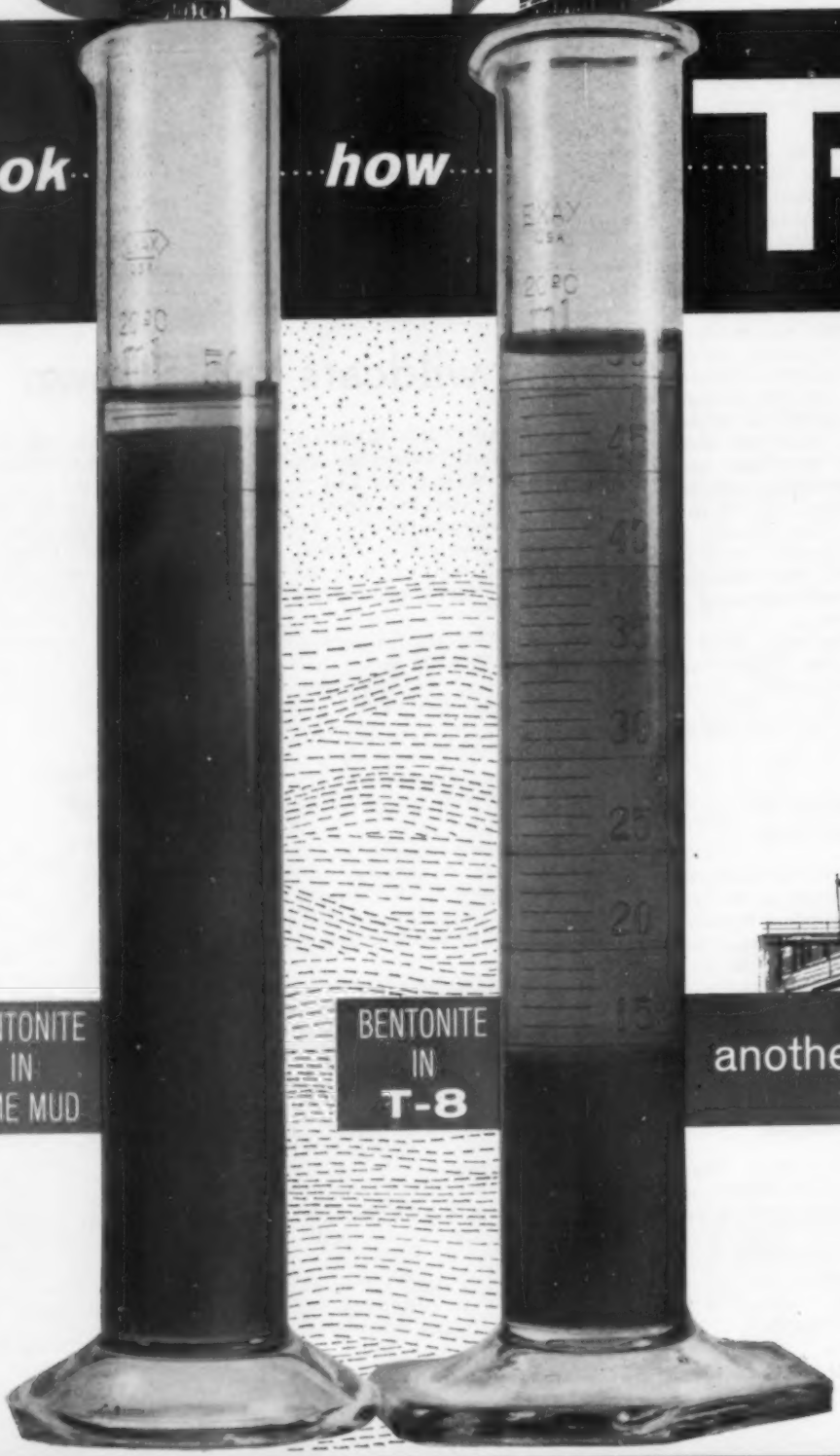
Flint Ridge extended in Pennsylvania

A west extension to Flint Ridge field was announced by the Clinton Oil Co. Their 8 J. D. Spencer, Lot 2, second quarter, Hopewell Township, Licking County made a good showing natural in the Clinton sand at 2,968-3,017 ft. and gaged 300 bbl. after fracture.

well a

well b

Look how T-8



another *well done*

.....and Magcobar engineering cut mud cost on well b

NEW ORLEANS AREA

	depth	type mud	weight mud	cost of mud
a	13,600 ft.	Lime	15.6 lb./gal.	$130,000
b	13,590 ft.	T-8	15.6 lb./gal.	$ 65,000

All along the Gulf Coast, savings have been substantial using T-8 instead of other muds in drilling shale formations. The secret of T-8, as the graduates to the left show, is that it reduces the hydration and dispersion of solids, minimizing the build-up of formation solids in the mud system.

With other muds, shale solids become part of the drilling fluid, increasing the viscosity. Water, added to reduce viscosity, lowers the mud weight, and new barite must be added. The additional barite and water increase the volume, so that expensive mud is jetted. With T-8 you can maintain good mud properties with less jetting, less barite, and at impressive savings.

The successful field performance of T-8 confirms Magcobar's basic approach to drilling fluid problems: Developing better products to solve specific drilling problems, and training better mud engineers to insure the highest level of performance from these products.

T-8 is only one of Magcobar's many answers to the problem of high drilling costs. The right products *used right* by Magcobar can cut costs on your next well, too.

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In the states of Michigan, Ohio, Iowa, West Virginia, Illinois, Pennsylvania, and New York, there are thousands of gas storage wells similar to the one shown below. They may be hooked up differently according to the operator's needs — but 80% of these gas storage wells are controlled with Orbit Valves. This is not accidental by any stretch of the imagination — gas distributing companies must be in a position to deliver large volumes of gas during winter months. Valves, by necessity, must be dependable. Orbit Valves meet the qualifications for this all-weather tough service, they will not freeze up.

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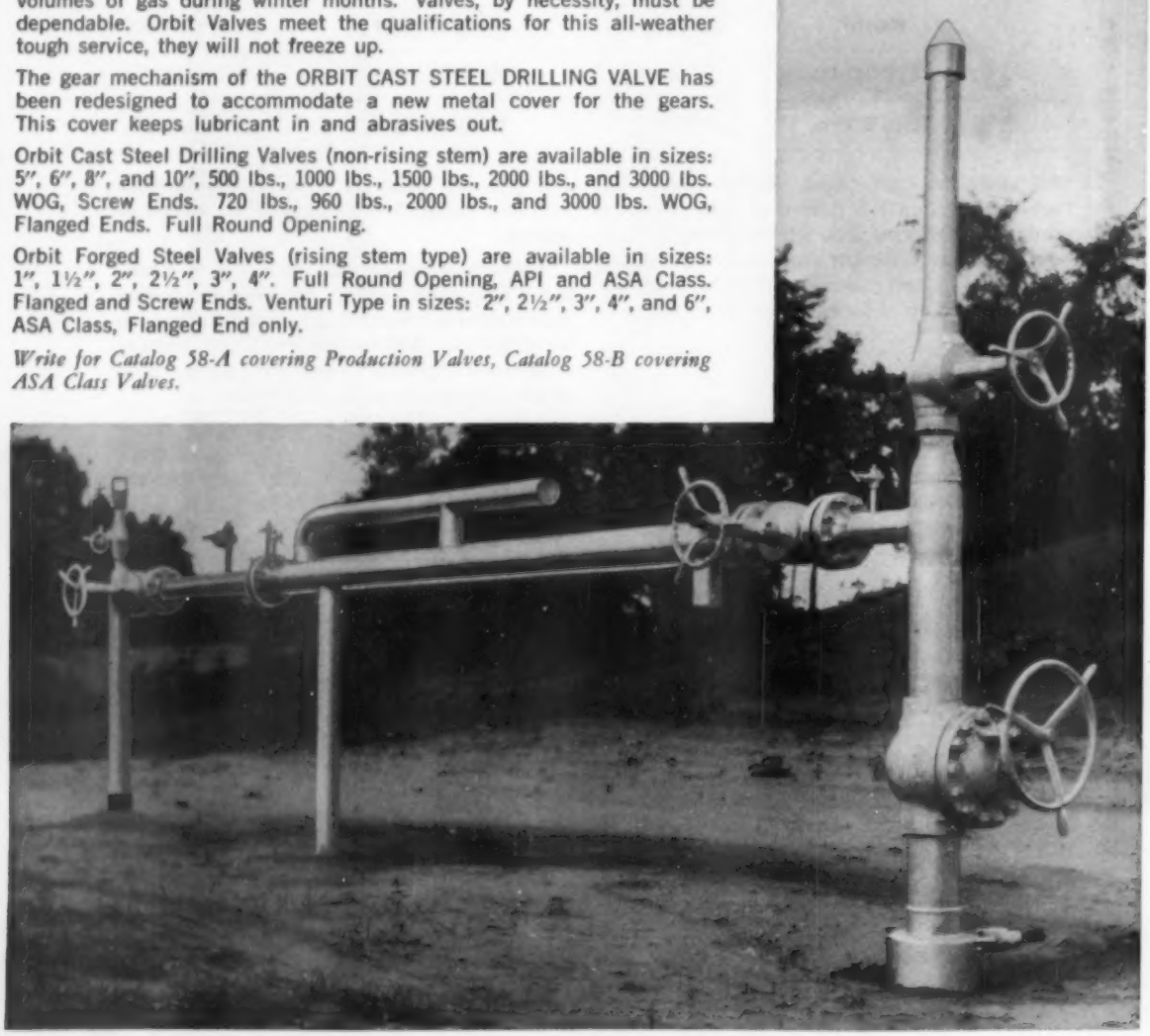
Orbit Forged Steel Valves (rising stem type) are available in sizes: 1", 1½", 2", 2½", 3", 4". Full Round Opening, API and ASA Class. Flanged and Screw Ends. Venturi Type in sizes: 2", 2½", 3", 4", and 6", ASA Class, Flanged End only.

Write for Catalog 58-A covering Production Valves, Catalog 58-B covering ASA Class Valves.

This Gas Storage Well is located 10 miles west of Big Rapids, Michigan.



New find in Nebraska

Denver basin exploration in western Nebraska picked up another discovery. It is Wyoming Western Oil Co.'s 1 Bartow in C SW NE 11-14n-58w, Kimball County.

This Dakota "J" sand Cretaceous strike was completed for a pump gage of 375 bbl. of oil daily from perforations at 6,906-11 ft. Location is 1½ miles southwest of Benziger field and 2 miles west of Gehrke field.

New Williston basin map is available

Midland Map Co., 412 North Big Spring, Midland, announces a new Williston basin field map showing oil fields, county seats, and all major highways. Scale is 1 in. equals 18.18 miles. The map is revised up to January 1959. It shows fields in eastern Montana, South Dakota, North Dakota, Manitoba, and Saskatchewan. Due to the upsurge in activity in North Dakota's portion of the basin, the new Williston basin map will be of great help to those interested in this region.

Summerland well completed offshore

THE second well drilled from a drilling platform in 100 ft. of water on a 5,500-acre offshore lease at Summerland, Santa Barbara County, has been completed. Standard Oil Co. of California, as operator for itself and Humble Oil & Refining Co. hasn't released any details on the well. The discovery well on the lease tested at a rate of 865 bbl. daily. No producing intervals were revealed but the discovery had a total depth of 7,531 ft. and the latest completion 7,850 ft.

California gets new Monterey County field

Bandini Petroleum Co. turned up a new field discovery in Monterey County with a wildcat about 6 miles northwest of King City. The Bandini discovery well, 54X Doud, was completed for 70 bbl. daily, 10-15%, cut in an upper Miocene-Monterey shale at 2,995-3,174 ft.

The drill site falls only 1,000 ft. southeast of a Texaco Co. well which tapped subcommercial production in the area in 1949. This was Monterey's second try in the area. An earlier wildcat was abandoned at 3,802 ft. about ½ mile northeast of the discovery in December, last year.

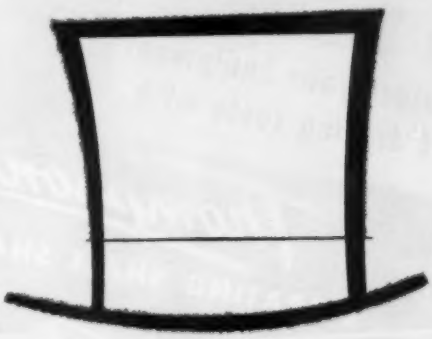
New pool for California's Oxnard

A NEW pool discovery turned up by Max Pray in the Oxnard field of Ventura County late in 1957 was given an important extension by Standard Oil Co. of California. Standard stepped out about ¼ mile northeast of Pray's discovery to bring in a 350-bbl. daily well in the Oligocene-Sespe at selectively perforated intervals between 7,070-8,315 ft. Production was 31° gravity through a 12/64-in. choke with 105 M.c.f. of gas. Pray's discovery well, 1 Max Pray-Donlon, tapped the Sespe at 7,748-67 ft. for initial production of 740 bbl. daily.

Deep Los Angeles test running logs

Standard Oil Co. of California, Western Operations, Inc., was running logs in 1 Carlin Community, the deepest test drilled yet in the Los Angeles Basin at 15,812 ft.

The operator still had set only 1,005 ft. of 13⅜-in. casing in the hole. It is located in NW NW 14-3s-13w, in the community of Lynwood.



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Here are statewide spacing rules in U.S.

Alaska

Oil wells must be located on a governmental quarter section or lot of not less than 150 acres and be a minimum of 500 ft. from boundary line of such quarter section or lot and 1,000 ft. from nearest drilling or producing oil well in same pool. Gas wells must be located on a governmental section, or lot of at least 600 acres and not closer than 1,500 ft. to boundary line of section or lot, nor closer than 3,000 ft. to nearest drilling or producing well in same pool.

Alabama

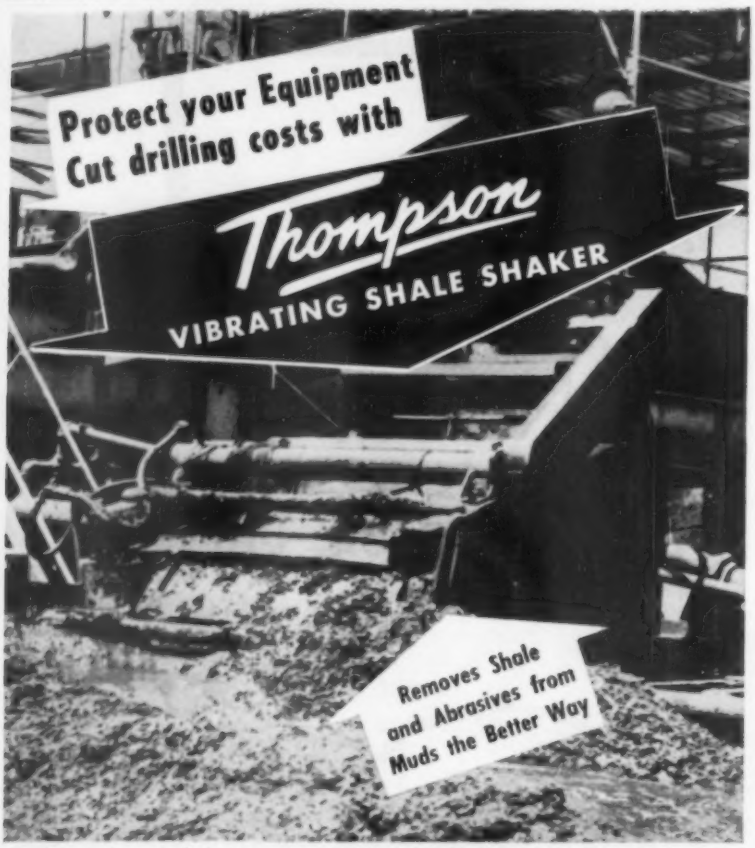
Oil wells must be located not more than 150 ft. from the center of a 40-acre unit.

Gas wells must be located on a drilling unit of a least 40 acres but not more than 640 acres.

Arizona

Oil wells must be located no more than 100 ft. from center of a 40-acre unit.

Gas wells must be located on a 640-acre unit.



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Arkansas

Wildcat wells must be drilled 330 ft. from the lease line.

Colorado

Depth 0-2,500 ft. Minimum 300 ft. between wells to same common source of supply and 200 ft. from lease line.

Depth over 2,500 ft. Minimum 1,200 ft. between wells to same common source of supply and 600 ft. from lease line.

Kansas

Must be drilled in approximate center of tracts containing 20 acres or less and 330 ft. from lease line to obtain full acreage attribution for allowable purposes. Location on 40-acre tracts not specific.

Louisiana

Oil wells: Depth 0-3,000 ft. No initial spacing requirements.

Depth over 3,000 ft. Minimum 330 ft. from lease line and 900 ft. from any permitted, drilling, or producing well to same pool.

Gas wells: Minimum of 330 ft. from lease line and 2,000 ft. from any permitted, drilling, or producing well to same pool.

Mississippi

Oil wells must be located on drilling unit of at least 40 acres or governmental quarter-quarter section of at least 36 acres, and be 330 ft. from drilling unit boundary and 660 ft. from any drilling or producing well.

Gas wells must be located on drilling unit of at least 320 acres or governmental half section of at least 300 acres, and be 990 ft. from drilling unit boundary and 1,980 ft. from any drilling or producing well.

Montana

Wildcat wells must be 330 ft. from lease line.

Oil wells must be 330 ft. from lease line and 990 ft. from any drilling or producible well to same reservoir on same lease or unit.

Gas wells must be 1,320 ft. from lease line and 3,700 ft. from any drilling or producible well.

Oklahoma

Depth 0-2,500 ft. Minimum of 165 ft. from lease line and 300 ft. from any drilling or producible well to same common source of supply.

Depth over 2,500 ft. Minimum of 330 ft. from lease line and 600 ft. from any drilling or producible well to same common source of supply.

Texas

Minimum of 330 ft. from lease line and 933 ft. from any drilling or completed well to same horizon on same lease.

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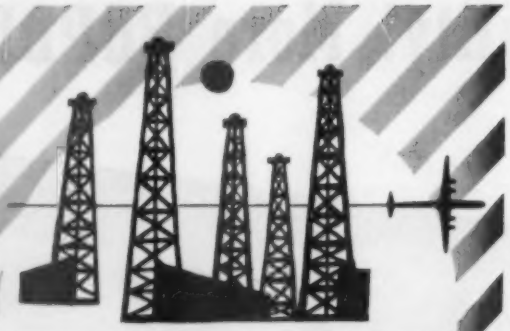

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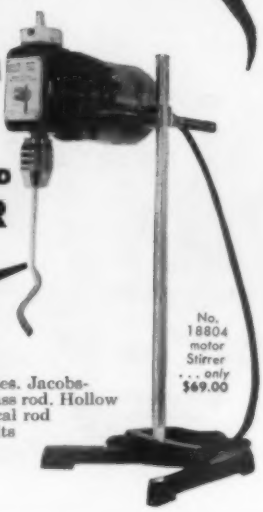

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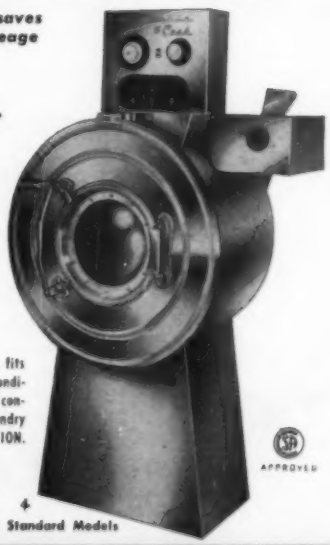

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Deep tests eyed in California

TWO WELLS, one in Kern County and the other in the Los Angeles Basin, are currently vying for honors as the deepest well drilling in California. Presently in the lead is:

...A wildcat being drilled by Richfield Oil Corp. 2½ miles northwest of production in the North Tejon field. Actually, a major fault separating the wildcat, 22-15 KCL-K, from North Tejon makes this deep test stand on its own as unrelated to any nearby production. It was drilling ahead below 16,200 ft in NW NW 15-11n-20w. Richfield reports that the well will be taken down as long as it is doing the job designed for it, but that no depth marks are in mind.

...In Los Angeles County, Standard Oil Co. of California was nearing the 16,000-ft. mark with a wildcat in the community of Lynwood southeast of downtown Los Angeles. This wildcat, 1 Carlin Community, originally was slated for 15,500 ft. However, after logging it at that depth, Standard resumed drilling and was below 15,962 ft. The test broke the Los Angeles Basin depth mark last month when it passed the 14,-950-ft. mark.

Pool added to California's Paloma

KERN COUNTY'S Paloma field was given a new pool discovery by Hamilton Dome Oil Co., Ltd., with a well in NW SW 20-31s-26e on the northeast edge of the field. The operator found the new pool at 10,920-80 ft. in an 11,713-ft.-deep hole. It was flowing 48 bbl. daily of clean 33°-gravity crude.

Just two locations east of the discovery, Hamilton recorded a flow rate of 500 bbl. daily on a drill-stem test of a second well in the play. The DST was conducted in the main Paloma sand 10,914-62 ft. The operator was preparing to test water shutoff after cementing 7-in. casing at 10,914 ft.

Shallow test slated in northern California

W. C. Thompson Gas & Oil Exploration Co. was conducting tests on a second shallow wildcat in the Redwood Valley region of northern California's Mendicino County.

While this second well was being tested, the operator was installing a pump on the first well 300 ft. to the northwest. The first test, 1 Ukiah, reportedly had shows at 650-850 ft. The well being tested, 2 Ukiah, total depthed at 550 ft. These two wildcats rank as the most remote in the state currently. Nearest production to either is in the inland central California gas counties 60 miles to the east.

New books for oil finders

Rinehart Oil News Co., Dallas has announced the publication of a new 190-page reference volume—1958 Structure Maps of Texas Oil Fields.

The fifth annual edition of the book contains all map exhibits, which were suitable for reproduction, as submitted during the past year to the Texas Railroad Commission by operators for rulings on field discoveries, injection projects, and Rule 37 Permits.

The material is arranged by counties and by districts, and bound into a single indexed volume.

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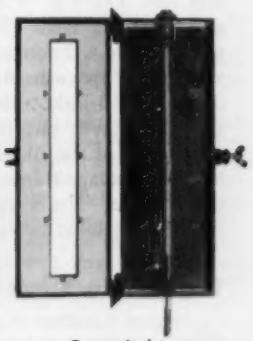

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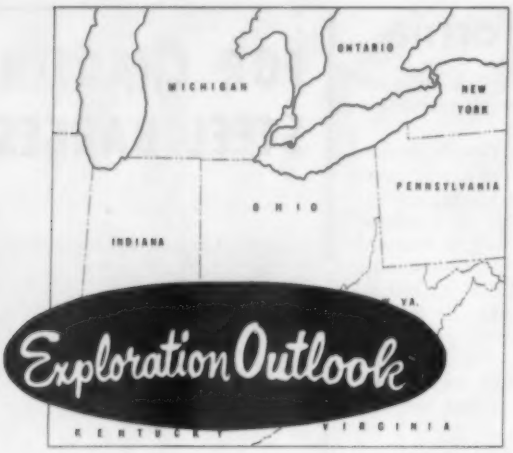


. . . appraising the future by surveying the past

EAST OF THE MISSISSIPPI RIVER a spirited exploratory campaign is under way in Ohio, Kentucky, Michigan, the Illinois basin, and in the Appalachian Mountain states. This return of the drill to its birthplace is especially significant in this Centennial year of oil. Eastern wildcat events in recent years have been scarce, but rest assured that 1959 will be the big year for drilling in oil's cradle.

Record Winter Conditions

. . . fail to keep hot wildcat enthusiasm from cooling off in the southern reaches of the Michigan basin. Two Trenton discoveries in southern Michigan have established a new northwest-southeast trend through Calhoun, Jackson, and Hillsdale counties. This 12-mile trend sired a brisk leasing play throughout southern Michigan and northern Ohio. Trenton isn't new here. Just 2 years ago Scipio field opened in northwestern Hillsdale County as the best Trenton field in Michigan. The 800-bbl. strike was followed by several months of disinterest. In September 1957 a blowout at a field well put Scipio in the headlines all over the oil country. Now there are 25 producers.

The two new strikes in this trend are Tom Mask-McClure Oil Co. 1 Rosenau (296 bbl. per day) and Turner 1 Blair (265 bbl. per day). These new pools mean a determined search for Trenton oil is with us. This rash of wildcatting will plug up and down the 12-mile trend, spill over into other counties, and maybe into northwestern Ohio. The Trenton is one of the oldest producing zones in oildom, but just escaped being shrugged off in Michigan until Scipio. The Trenton and Michigan will figure highly in wildcat news this year.

High Ohio Success Ratio

. . . means another big year in development work in this storehouse of Appalachian oil and gas. Buckeye drillers set an impressive 72% success ratio in over-all drilling last year. A recent completion in New Lexington pool, Perry County, made an estimated 1,000 bbl. of oil per day after fracture of the prolific Clinton sand. Wells like this plus an increased exploratory trek into northeastern counties will keep Ohio up front in eastern activities.

Increased Appalachian Gas Reserves

. . . give West Virginia, New York, and Pennsylvania explorers hopes for real wildcat success in the complex mountains and valleys of the East. One of the best new fields in this area is Glady in West Virginia. This field has several good gassers, no dry holes, and plans for increased development work this year.

Only icy winds keep the barges off Lake Erie where first production was opened on the U. S. side last year. With the coming of spring we can expect a big shove into these waters with gas as the objective. This play won't be confined to the U. S. side of the lake, because Canadians are stepping up their long-active program in Lake Erie waters.

Remote Texas Exploration

. . . injects new life into southwestern areas. The deep Edwards trend is moving westward across the vast, meagerly explored wastes of northern Webb and southern Dimmit counties. Impetus to the Webb County play was given by Copane Oil Co.'s recent gas strike more than 35 miles southwest of the previous most southwesterly production on the trend. The Copano strike moves Texas production in this remote area almost to the Rio Grande. There are definite signs of a real spurt in wildcatting in this part of the state. Look for news from the Edwards lime country soon.

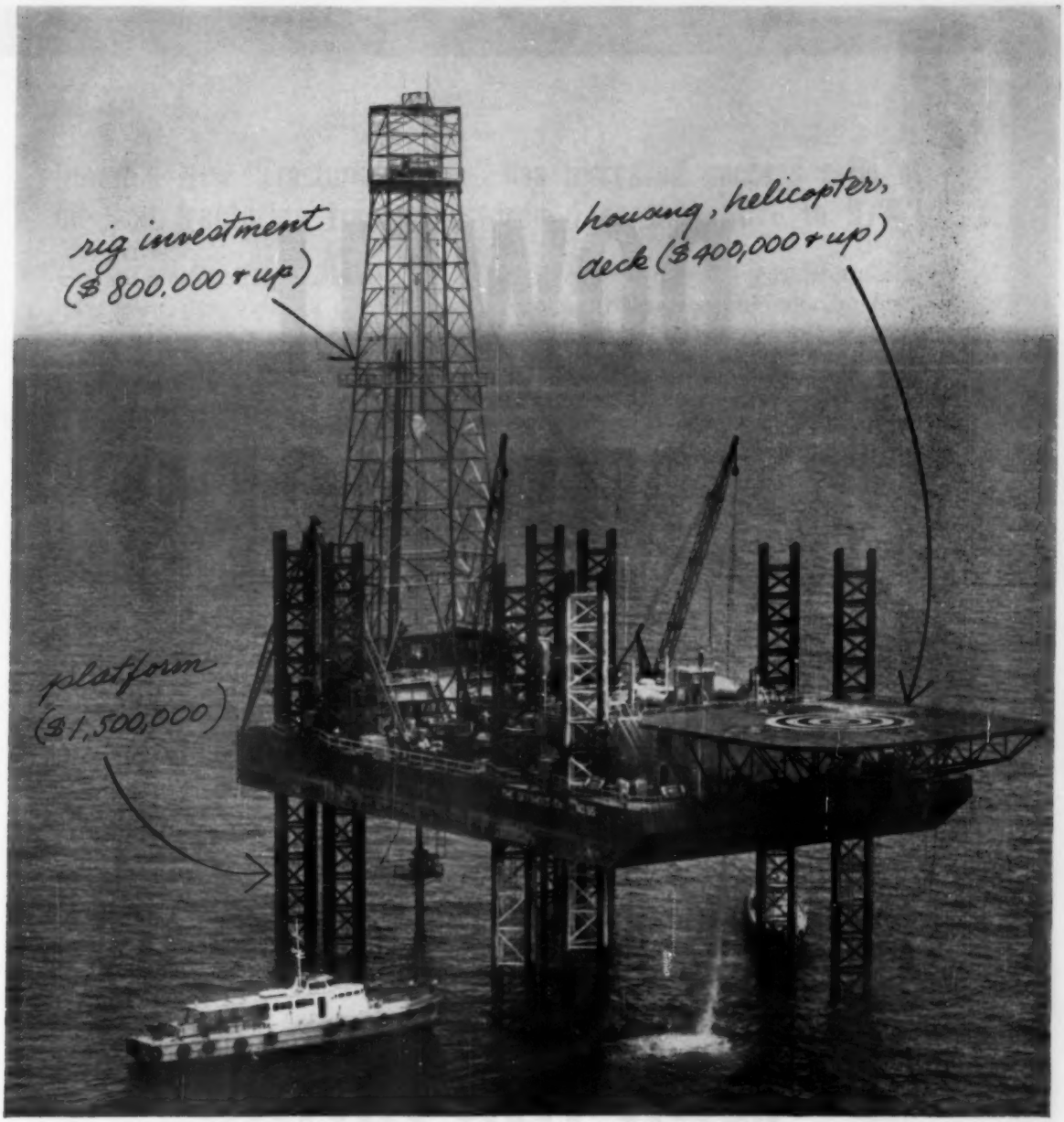
Texas' Elusive Delaware Basin

. . . didn't pan out too well as an ultradeep province, but shallow exploration in the north-central portion of this big bowl is proving itself in a big way. Main objective is the Delaware sand (found from 1,000-4,000 ft.). A busy attack in both the Texas and New Mexico portion of the basin is turning up some excellent wells. The deep drilling in the Delaware isn't over, but for now operators are shooting at shallow sands.

Watch Williston

. . . for new drilling records are expected this year. A dozen new fields and important extensions have already been put on the 1959 records. Announcement of new locations each week on and off the Nesson anticline indicates gloom is not in the Williston dictionary. Big plays are centered around last year's strikes in Burke and Bottineau counties. A continued probe into the pre-Mississippian rocks in the Beaver Lodge area is also slated.

—John C. McCaslin.



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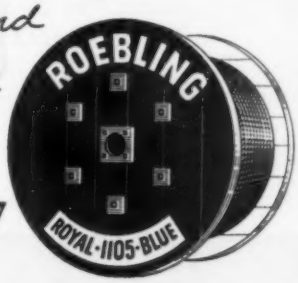
you can't afford
not to use the
best rope



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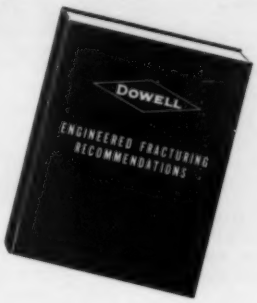
DOWELL ANNOUNCES

an important, new advance in oil and gas well fracturing

Dowell's New "Fracturing Guide" has increased success ratio of oil well fracturing treatments from less than 60% to 97%!

Dowell engineers, working closely with leading oil and gas producers, have now developed a revolutionary new technique for engineering fracturing treatments to yield optimum results.



More than 300 treatments using this new method have been made. They indicate that the success ratio of fracture treatments can be increased by more than 50 per cent.

This new system of designing well treatments is based on tables and graphs contained in a manual now in use by Dowell engineers. In preparing the manual, "Engineered Fracturing Recommendations," Dowell engineers consolidated and correlated industry-accepted calculations, reservoir data, frac fluid properties, and their own experience from thousands of treatments. The "Guide" has been equally effective on both old and new wells.

How is the "Guide" used?

First, your Dowell engineer needs a reasonable amount of information about your well. Then he uses the charts and formulas compiled in the manual to design a fracturing treatment to fit that particular well. The "Guide" helps you:

1. *To choose the proper fluid and additives to meet reservoir conditions.*
2. *To predict the fracture area created on any treatment.*
3. *To choose the proper treating volume on re-treatments.*
4. *To get high-capacity fractures on each treatment.*
5. *To reduce sandouts that are not planned.*
6. *To predict surface pressure conditions prior to job performance.*

Results have been a spectacular increase in the number of successful jobs. Benefits have included faster payout, lower lifting costs, high production and greater ultimate recovery because of *better decline curves*. Really *engineered* fracturing using the new "Guide" is available *only* from Dowell.

This extra service costs you nothing — yet the benefits have been nothing short of amazing. Call your nearest Dowell engineer for more information. Get him to *engineer* the treatment for your next well. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

Services for the oil industry — DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Discovery wells

WESTERN CANADA

Alberta: Amerada 16-15-42-7 Crown Willisden Green, LSD 16, 15-42-7w5. Cardium oil well. TD 8,480 ft.

British Columbia: Gulf States-Imperial 2 Clarke Lake, 95-L-94-J-9. Slave Point gas discovery. TD 8,039 ft.

COLORADO

Montezuma County: Basin Gas Co. 1 Ellis, SW NE 8-35n-13w. IPP 5 BOPD, Gallup discovery, new field. TD 1,107 ft.

NORTH DAKOTA

Bottineau County: Cappy Ricks, Tom Jordan, Stekoll Oil & Gas Co. 1 John Johnson, SE SW 19-168n-82w, IPP 53 BOPD, Kibbey discovery, new field. TD 4,050 ft.

Burke County: Stewart Petroleum Co. 1 Olsen, C SW NE 3-160n-94w. IPF 105 BOPD, 178 BWPD, Nesson 7,763-78 ft. Nesson discovery, new field. TD 7,915 ft Nesson.

Cappy Ricks et al. 1 Arthur M. Johnson, NW NW 34-162n-91w. IPF 62 BO 18 hours, 18/64-in. choke, Nesson 6,323½-29¼ ft. Nesson discovery, new field. TD 6,459 ft.

KANSAS

Stafford County: Isern 1 Haynes, NW NW SE 22-25s-15w. IP 46 BOPD, Mississippian 4,251-60 ft., 35.4°. TD 4,580 ft. Opens Haynes pool.

Sumner County: Shawer-Armour 1 Markley, NW NW SE 22-30s-1e. IPF 28 BOPD, Simpson 3,810-14 ft., 49°. TD 3,814 ft. Opens Markley pool.

NORTH LOUISIANA

Claiborne Parish: Alvin M. Jackson and Cheyenne Oil Corp. 1 H. N. Greene Unit, 6-23n-7w, 3 miles northeast of Haynesville. IP 726 BOPD, 18/64-in., 46.9°, TP 2,050 psi., GOR 1,185 cu. ft. per barrel, perf. 10,383-10,497 ft., Smackover. TD 10,646 ft. Smackover discovery well North Haynesville field.

Concordia Parish: Calto-Gulmon 2 Sharp, 21-4n-9e. IP 136 BOPD, ¼-in., 41°, TP 550 psi., GOR 300 cu. ft. per barrel, perf. 7,096-7,102 ft., Wilcox-Minter sand. TD 7,113 ft. Elev. 64 ft., Wilcox 4,974 ft., base Baker shale 6,817 ft. New pay in South Roseland field.

SOUTH LOUISIANA

Beauregard Parish: Lone Star Producing Co. et al. 1 Odegard et al. Unit, 26-5s-11w. IP 300 BOPD, 10/64-in., 52.4°, GOR 640 cu. ft. per barrel, TP 1,200 psi., perf. 8,001-06 ft. TD 8,351 ft. New pay in Singer field.

NEBRASKA

Kimball County: A&B Drilling Co. 1 Cabella, NE NE SW 29-13n-54w. OWDD. OTD 6,190 ft. IP 90½ BOPD, "J" sand discovery, new field. TD 6,197 ft.

NEW MEXICO

Eddy County: Chambers & Kennedy 1 Monterey-State, 32-18s-31e, 1½ miles west of Shugart field. IP 62 BOPD, 22/64-in. choke, 34°, GOR 110:1, Queen 3,265-3,500 ft. TD 3,552 ft., elevation 3,574 ft.

NORTHWEST NEW MEXICO

San Juan County: Tennessee Gas Transmission Co. 2-USA-W.01 Berger, NW NW 23-26n-11w. IPF 6,681 M.c.f.d., Dakota; 6,262 M.c.f.d., Gallup, Dakota-Gallup discovery, new field. TD 6,455 ft.

Utah Southern Oil Co. 1 Government-Newman, SE NW 27-27n-13w. IPP 194 BOPD, Pictured Cliffs discovery, new field. TD 970 ft.

El Paso Natural Gas Co. 103 Huerfano, SW NE NW 3-26n-10w. IP 3,342 M.c.f.d., Gallup, ¾-in. choke; 4,460 M.c.f.d., Dakota. TD 7,030 ft. New pay (Gallup).

OKLAHOMA

Grant County: Warren-Bradshaw Exploration Co. 1 Yerian, C SE SE 9-27n-6w. IP 1,664 M.c.f.d. Cherokee-Pennsylvanian sand 4,908-12 ft. TD 5,001 ft. Gas discovery.

TEXAS GULF COAST

Bee County: Bridwell Oil Co. 11-A H. C. Wood, Jose Maria Castillo Sur., A-14, 4 miles southeast of Blanconia. AOF 12,800 M.c.f.d., dry gas, shut-in TP 2,042 psi., perf. 5,025-33 ft., Vicksburg. TD 5,610 ft. New pay in South Blanconia field.

Chambers County: Meredith & Co. et al. 2 Tyrekl-Dubois, HT&B Sur., A-153, 6½ miles southwest of Winnie. IP 172 BOPD, 10/64-in., 34.1°, TP 750 psi., GOR 595 cu. ft. per barrel, perf. 8,272-76 ft., Frio F-1 sand. TD 8,552 ft. New pay in North Willow Slough field.

Nueces County: Subsurface Reserve Corp. and Morris Cannan 1 Cullen M. Briggs et al., Mantor, Briggs & Kuykendall Subd., Blk. 17, 2 miles northwest of Banquete. IP 44.73 BOPD, ⅛-in., TP 1,000 psi., GOR 6,380 cu. ft. per barrel, perf. 5,950-87 ft., Vicksburg. TD 6,505 ft. New reservoir and extension in Mantor-Briggs field.

Newton County: Spur Oil Co. 1 Jack Holmes et al., S. Swift Sur., A-374, 9 miles southeast of Call. IP 73.26 BOPD, 9/64-in., 45.4°, TP 450 psi., GOR 9½ cu. ft. per barrel, perf. 6,997-7,000 ft., Yegua 4-A sand, TD 7,900 ft. Second well and new pay in East Dougar field.

Victoria County: Atlantic Refining Co. 1 A. G. Dreier, William J. Eaton Sur., A-164, 3 miles southwest of Mission Valley. AOF 22 M.M.c.f.d., dry gas, shut-in TP 475 psi., perf. 976-46 ft., Miocene. TD 1,610 ft. New pay in Meyersville field.

WEST TEXAS

Borden County: Sinclair Oil & Gas Co. 1 Susie Koonsman, 27-2-T&NO Sur., 11 miles southwest of Justiceburg. IP 195 BOPD, 32/64-in. choke, 40°, GOR 1,146:1, TP 125 psi., Strawn 8,203-10 ft. TD 8,557 ft., ground elevation 2,600 ft. Originally completed as discovery well of Koonsman-Spraberry field.

Ector County: Gibraltar Oil Corp. 1 Edwards Ranch "32," Sec. 32, Blk. 43, T3S-T&P Sur., 17 miles southwest of Odessa. IPP 41 BOPD, 34°, GOR 711:1, Grayburg 4,060-86 ft., TD 13,465 ft., PB 4,005 ft. Originally completed as discovery well of V. H. Z. (Devonian) field.

Pan American Petroleum Corp. 1 Cahill "B," Sec. 21, Blk. 46, T1S-T&P Sur., 15 miles east of Kermit. IPP 163 BOPD, 34°, GOR zero, Wolfcamp 7,406-7,805 ft. Recompletion. Wolfcamp discovery in Wheeler-Devonian field.

Garza County: Continental Oil Co. 1 Thuett, Sur. 1, SF 1439, A-1063, 4 miles northwest of Post. IPP 105 BOPD, 36°, GOR 427:1, Glorieta 4,029-61 ft., TD 4,145 ft. New pay in Threeway field.

Reagan County: Triple L Oil Co. 1 University, Sec. 12, Blk. 48, University Lands Sur., 8 miles south of Big Lake. IPP 61 BOPD, 32°, GOR 595:1, San Andres 2,240-56, 2,256-64 ft. TD 2,549 ft.

Runnels County: Jim B. Curry 1 H. G. Bradley, Henry Garmes Sur. 540, 5 miles north of Ballinger. IPP 157 BOPD 45°, GOR 550:1, perforated 2,395-2,400 ft. TD 2,541 ft. Recompletion.

Tom Green County: L. E. Scherck 1 H. L. Curry, Sec. 66, L. Halfin Sur., 2 miles southwest of Miles. IP 6,200 M.c.f. gas, Strawn 4,292-98 ft. TD 5.115 ft.

Pecos County: Phillips Petroleum Co. 1 University "EE," Sec. 7, Blk. 24, University Lands Sur., 9 miles southwest of Baldridge, 15 miles northwest of Puckett field. World's deepest hole. IP, none. TD 25,340 ft., elevation 2,905 ft. Sample tops: Yates 2,225 ft., Leonard 5,320 ft., Wolfcamp 8,340 ft., Devonian 13,194 ft., Ellenburger 16,708 ft. Electric log tops: First Devonian 13,185 ft., Fusselman 13,325 ft., Montoya 13,375 ft., second Simpson 13,425 ft., second Devonian 13,764 ft., Woodford 13,804 ft., third Devonian 13,860 ft., Fusselman 14,052 ft., Simpson 14,280 ft., (base) McKee 15,340 ft., Tulip Creek 23,020 ft., Waddell 24,155 ft., Oil Creek 24,265 ft., Connell 24,532 ft., Joines 24,702 ft., Ellenburger 24,967 ft.

Winkler County: The Texas Co. 1 J. A. Thomas, Sec. 13, Blk. B-5, PSL Sur., 4 miles southeast of Kermit. IP 1,300 M.c.f. gas, plus 15 bbl. condensate, Devonian 9,478-9,520 ft. TD 11,930 ft., PB 9,540 ft. Elevation 2,865 ft.

Yoakum County: Shell Oil Co. 1 C. E. Granger, Sec. 487, Blk. D, J. H. Gibson Sur., 8 miles east of Plains. IPP 188 BOPD, 28°, GOR 252:1, Clear Fork 6,592-6,780 ft. TD 13,129 ft., elevation 3,579 ft.

WEST CENTRAL TEXAS

Hood County: Boren Oil & Gas Co. 1 Lackey, Lorenzo DeZavala Sur., A-1698. IP 1,500 M.c.f. gas. TD 1,450 ft.

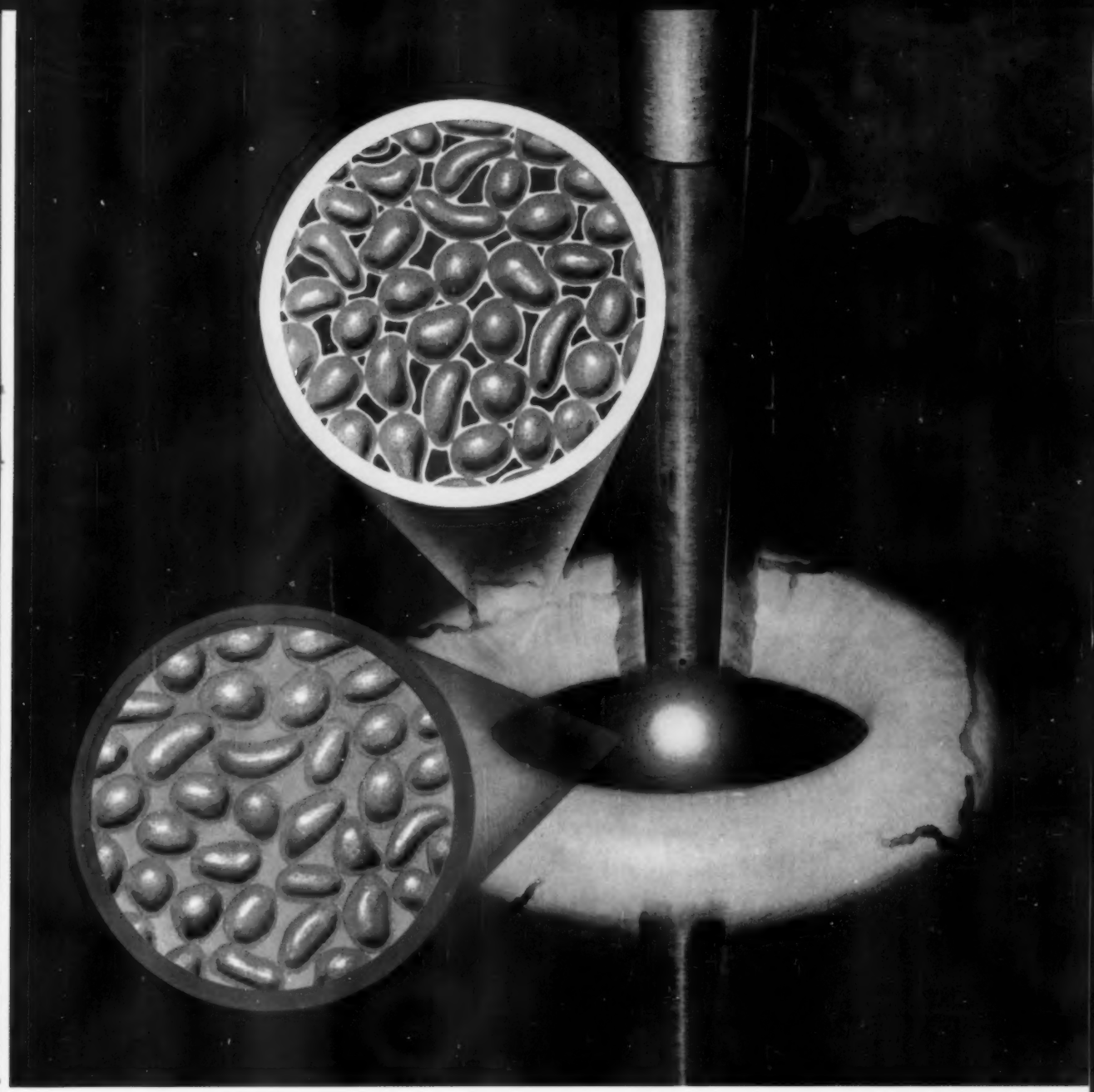
Palo Pinto County: Fryer & Hanson Drilling Co. 4-E Stuart (formerly 2-E), Sec. 54, Blk. 3, T&P Sur., 14 miles northwest of Strawn. IP 99 BOPD, open 2-in., 40°, GOR 899:1, TP 150 psi., perforated 1,698-1,728 ft. TD 1,960 ft.

Taylor County: Warren, Choate & Wico 17 W. O. Black, Sec. 3, Blk. 7, SPRR Sur., 13 miles southeast of Potosi. IPP 32 BOPD, 40°, GOR 435:1, pay 1,834 ft. TD 1,837 ft.

Throckmorton County: Tennessee Gas Transmission Co. 1 Cora Beaty, Sec. 676, TE&L Sur., A-277, 6 miles southeast of Woodson. IPP 109 BOPD, 41°, GOR 943:1, perforated 4,576-4,694 ft. TD 4,660 ft. Recompletion.

WYOMING

Fremont County: Trigood Oil Co. 1 Tribal, C NW SW 21-6n-3w. IPP 61½ BOPD, Dinwoody discovery, new pay. TD 5,420 ft.



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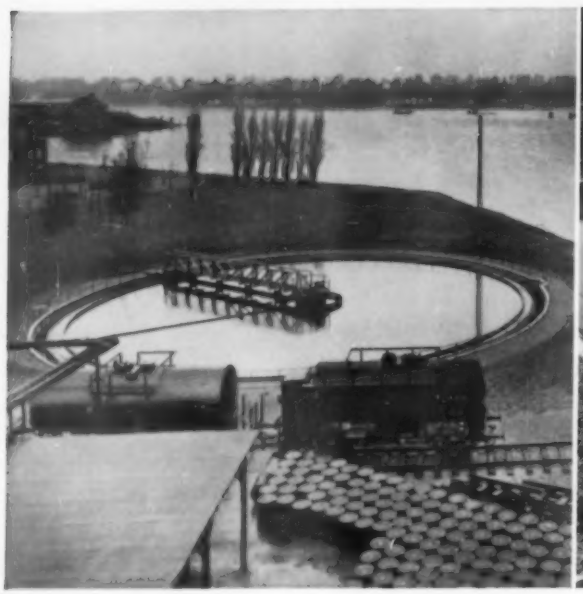

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Foreign Profits Attractive

. . . to U. S. drillers, but know-how becomes more important as competition grows, according to Brown Drilling head.

"IF OIL companies find profit in foreign operations, it also makes sense for the drilling contractor. He is, after all, the number one assistant of the oil company."

That's how Arthur J. (Art) Heiser, new president of Brown Drilling Co. and Brown International Drilling, Long Beach, explains his companies' heavy concentration on foreign operations.

"We feel that profits to be gained are greater in this field than those available in domestic drilling, considering the investment involved," Heiser explains.

"But, I must point out right here that the honeymoon is over for contractors in foreign fields. In a great many locations, Venezuela to name one with which I am familiar, the competition is just as keen as in California or any other location.

"So, in overseas contracts as well as at home, the time has come to think long and hard about the elements involved in profitable drilling."

Arthur J. Heiser . . .
. . . "know your costs."

Definite views . . . Heiser, who at 36 is one of the youngest drilling company presidents in the business, has some definite ideas about how a contractor should operate.

"Know your costs."

That's the key, according to Heiser.

"Still, day in and day out people in the business who certainly should know better are deliberately flaunting this basic rule of the business. It is a principle I've tried hard to stick with since my first day as a driller.

"I bid every job for a profit. I refrain from the temptation of running junk equipment. I hire good men, or none at all. I use good machinery, or pass the business. Any bidding formula less strict invites financial disaster.

"And this rule is even more difficult in times like these when competitors may not have replaced machinery for years and may be bidding jobs without figuring one whit of depreciation," Heiser adds.

Heiser also touched on oil operators who award jobs strictly on the basis of low bidder without regard for the contractor's equipment or personnel.

"We all know in the contracting business—and oil operators should know it by now—that the lowest bidder may be the cheapest, but he is not always the most economical."

What about business? Again, Heiser has an outspoken opinion.

"Conditions in drilling are tough today. And, they are tough in the entire industry. Drillers have reached a point where no one is making a fair profit and perhaps a majority of operators are making no profit at all.

"It would be nice to take a sweet Pollyanna look at things. But, the problem at hand concerns us all. There is simply not enough work to go around.

"Those of us in drilling, who haven't gone broke, can take hope in the recently expressed opinion of major banks that the world consumption of petroleum will expand and multiply with rapidity in the years immediately ahead of us.

"I hope so—for without an expanding market, our abilities may soon be without a market anywhere."

World traveler . . . With rigs currently drilling in such widespread locations as France, Turkey, Venezuela, Guatemala, and the United States, Heiser is seeing a lot of the world.

Brown Drilling traditionally has been a world traveling company. One Heiser philosophy is that rigs can be moved, even if the price is high. Rather than let a rig rust in idleness in a remote location awaiting new business, Heiser hustles around for work for it in some other part of the globe.

Brown Drilling rigs have been seen in such places as Bahrain Island, the Neutral Zone, Australia, New Zealand, and Trinidad in recent years as well as in areas where they are currently drilling.

Reunion . . . The naming of Heiser as president of the two Brown companies actually marks a reunion of Heiser and Brown.

After knocking around on a part-time basis in Wyoming oil fields as a boy, Heiser went to the Colorado School of Mines on a scholarship. He graduated with a petroleum-engineering degree.

It was while Ned Brown was building up Brown Drilling Co. that Heiser joined the company. In 1952, Heiser left Brown to form his own drilling company in California. After the death of his partner in a small plane crash in 1957, Heiser rejoined Brown Drilling.

Also at that time, Ned Brown sold his company to Sofina, a large Belgian utilities operating and engineering firm. Brown Drilling now consists of three companies: Brown Drilling Co., Brown International Drilling, and Brown Marine Drilling Co.

Help at home . . . Heiser is in the enviable position of being able not only to get a little wifely sympathy after a hard day at the office, but also to get some sound business advice from the spouse as well.

Mrs. Laura Heiser also is a graduate petroleum engineer. Before she married Art Heiser, she worked for a while as one of the few licensed women petroleum engineers in the world.

She now concentrates on being a domestic engineer. A full-time job of rearing two children precludes any more petroleum engineering work except for an occasional weekend discussion on some technical problem her husband has confronted.

●

▶▶▶ Personals

Ernest P. Miller, resident manager in Brazil for Cameron & Jones, Inc., Denver consulting engineers, and **Kay L. Berry,** senior staff engineer, have been elected directors of the company.

Joe Cowdrey has been transferred from the Houston office of Western Natural Gas Co. to Corpus Christi, Tex., as assistant division superintendent in charge of exploration.

Southwest Texas AIME Group Names New Officers

W. J. Bielstein, second from right, Humble Oil & Refining Co., has taken over as 1959 chairman of the Southwest Texas section of Society of Petroleum Engineers of AIME. He succeeds Todd Storer, third from left, Pan American Petroleum Corp. Other officers of the chapter will be, left to right, Bob Miner, Spartan Well Service, first vice chairman; J. J. Lawnick, American Petrofina Co. of Texas, secretary-treasurer; Storer, immediate past chairman; Bielstein; and W. B. Phillips, Union Producing Co., second vice chairman. Headquarters for the group is Corpus Christi.

L. S. McMillan, production engineer for Sunray Mid-Continent Oil Co. in Oklahoma City, has been promoted to staff production engineer. **Gordon Young,** junior geologist, has been promoted to geologist in Oklahoma City.

Jerry A. Cogan, a vice president and director of Imperial Oil, Ltd., Toronto, has been elected a director of Esso Research & Engineering Co. Cogan joined the Standard Oil Co. (N. J.) companies in 1932. He is a former head of Jersey's coordination and petroleum economics department. He joined Imperial in 1944 as assistant general manager of the manufacturing department.

Patrick J. Fazio, assistant vice president and manager of exploration and operations for McCulloch Oil Exploration Co. of California, has been promoted to vice president in charge of exploration and operations. **Paul J. Rigali,** assistant secretary and formerly assistant vice president and manager of the land and lease department, has been elected vice president and manager of the land and lease department. **Louis R. d'Assalenaux,** assistant vice president and manager of the administration and coordination department, has been named vice president in charge of administration and coordination. **Denis J. Gleason,** assistant treasurer and controller, becomes treasurer and controller.

J. H. Almand, assistant production superintendent for F. A. Callery, Inc., has joined Big "6" Drilling Co. as superintendent of rigs.

Walter H. Stanton, manager of engineering planning in Monsanto Chemical Co.'s Texas City plastics division, has been named technologist there, effective April 1.

Dr. Leo J. O'Brien and **Dr. Melvin A. Rosenfeld** have been named directors of new divisions at Pure Oil Co.'s research center. O'Brien becomes director of the production engineering research division. Rosenfeld will be director of exploration research.

Eugene T. Adair, executive vice president and general counsel for Texas Pacific Coal & Oil Co., has been named president. **H. B. Fuqua,** president and chairman, will continue as chairman and chief executive officer. **Hamilton Rogers,** vice president, will succeed Adair as executive vice president.

G. A. Schurman has been named manager of producing research, development and technical service, at California Research Corp.'s La Habra, Calif., laboratory. He will be in charge of activities in drilling, well logging, reservoir mechanics, and secondary recovery. **J. F. Ascarrunz** and **S. W. Ferradas** have joined California Research as research engineers at La Habra. **G. R. Naniche** has been named research engineer at the Richmond, Calif., laboratory. **J. F. Fernandez** and **Robert J. White** have joined the company as research chemists at Richmond.

Harold W. Moles, compressor-station superintendent for Pacific Northwest Pipeline Corp. in Baker, Ore., has been transferred to Pocatello, Idaho, as district pipeline superintendent.

A. B. Davis, Jr., assistant sales manager in Texas Natural Gasoline Corp.'s Gulf Coast division, has been named manager of supply. He will be in charge of natural gas liquids procurement and product exchanges. Davis will headquarter in Tulsa.

W. H. Smith, president of Big "6" Drilling Co., has been elected 1959 chairman of the Houston chapter of American Association of Oil Well Drilling Contractors. He succeeds **M. F. Clegg,** president of Clegg & Hunt. **Birk Windham,** Grey Wolf Drilling Co., is vice chairman, and **H. E. Treicher,** H.E.T. Drilling Co., is secretary-treasurer of the group.

Thomas T. Conger, general manager of Standard-Vacuum Oil Co.'s producing organization in Pakistan, has been appointed manager of Stanvac's producing department. He succeeds **Dwight E. Davis,** who has retired. Conger was with Humble Oil & Refining Co. before joining Stanvac's Indonesian affiliate in 1933. He moved to Calcutta after the company obtained concessions in India and Pakistan. He has been manager in Karachi since last August.

CONGER

▶▶▶ Personals

J. P. McCulloch has retired as vice president of American Overseas Petroleum, Ltd.

Albert Y. Woodward, Signal Oil & Gas Co.'s government-relations representative in Washington, has been elected a vice president.

R. K. Summy, formerly with Hancock Oil Co., has been elected vice president, general manager, and a director of Holly Development Co.

R. E. Hackbarth, The Texas Co.'s assistant division geologist in Houston, has moved up to division geologist there.

Marc F. Braeckel, Sinclair Refining Co.'s director of marketing and executive vice president, has been elected chairman of the board of the company, a manufacturing and marketing subsidiary of Sinclair Oil Corp. **Louis W. Leath,** vice president and general sales manager, western division, for Sinclair Refining, has been

BRAECKEL

LEATH

HOAR

elected a vice president of the parent company. **Leo J. Hoar,** vice president and general sales manager of Sinclair Refining's eastern region, will succeed Braeckel as vice president and director of marketing. Braeckel is a former president of Richfield Oil Corp. of New York, eastern marketing subsidiary of Sinclair Refining. Leath joined the company in 1922 and had been a director of Sinclair Refining for the past 4 years. Hoar has been with the Sinclair companies since 1934. He was elected vice president of the refining company in 1954.

Merrill W. Haas, vice president and a director of Carter Oil Co., has been given a 6-month leave of absence to serve as assistant coordinator in the producing coordination department of Standard Oil Co. (N. J.). He will succeed **N. Y. Ruth,** who has been temporarily transferred to London. The appointment is effective April 1.

Dr. Elton Soltes, research and design engineer for Delhi-Taylor Oil Corp., has been promoted to manager in special projects.

James DeGarmo, maintenance supervisor at Du Pont's Sabine River works, Orange, Tex., has been named division maintenance superintendent there. **John W. Brackin,** mechanical foreman, will succeed DeGarmo.

Walter J. Herridge, Jr., has been transferred by Lone Star Gas Co. from Temple, Tex., to the Shamrock, Tex., compressor station as superintendent. He succeeds **Cecil Cardwell,** who has retired.

John A. Croft, distribution department general engineer for Ohio Fuel Gas Co., has been promoted to supervisory engineer and Columbus Group system sponsor for Columbia Gas System Service Corp. He will headquarter in New York.

R. F. Bauer is president of Global Marine Exploration Co., new offshore drilling firm organized in Los Angeles. Other officers are **A. J. Field,** vice president and general manager, and **Hal Stratton,** vice president. All were formerly with the CUSS group, joint venture of Continental, Union, Shell, and Superior.

Four men will receive citations for service from the American Petroleum Institute's Division of Production at the API southwestern district meeting March 4-6 in Midland, Tex. They are **M. M. Brantly,** Brantly Drilling Co.; **G. T. Pearson,** Continental Oil Co.; **P. E. Fletcher,** Atlantic Refining Co.; and **R. P. Moscrip,** Shell Oil Co.

R. L. Milner has resigned as assistant manager of the Saskatchewan project of Tidewater Oil Co., operator, and Atlantic Refining Co., Columbian Carbon Co., and Ohio Oil Co. He will not be replaced. **Dr. A. D. Cumming,** chief geologist for Tidewater, will not become assistant manager of the project as reported in the Journal February 9.

B. F. Winborn, Jr., former co-owner of United Core, Inc., is president of Exploration Service Co., a new well logging and core analysis firm which has been organized in Houston. Other officers are **O. M. Wilkinson,** vice president and sales manager; **Stanley Wondrash,** vice president and instrument-manufacturing manager; and **J. W. O'Neal,** secretary-treasurer and general manager. All formerly were with United Core.

Four Standard Oil Co. (Ohio) vice presidents have been named to the new post of senior vice president. They are **Samuel H. Elliott, Elliott B. McConnell, Richard C. Sauer,** and **Alfred E. Wolf.** The appointments fol-

ELLIOTT

McCONNELL

SAUER

WOLF

lowed announcement that **Charles E. Spahr,** president, will become chief executive officer of the company. **Clyde T. Foster** will continue as chairman and will retain responsibility for public relations. Elliott, vice president for marketing, has been named senior vice president in charge of exploration and production. McConnell, who has been vice president in charge of manufacturing, becomes senior vice president, manufacturing and research. Sauer, vice president for supply and distribution, will be senior vice president, supply and transportation. Wolf, vice president, finance, will continue to head the finance department and will also be responsible for the accounting department as senior vice president. In other changes, **Joseph D. Harnett** succeeds Elliott as vice president and head of the marketing department. **Dr. Everett C. Hughes** will be manager of the new research department. **Alexander B. Clarke** has been named manager of the manufacturing department. **Joseph A. Stoll** becomes manager of the supply and distribution department.

James L. Wible, Carter Oil Co. district superintendent in Billings, Mont., has been named western division engineer in Denver. He succeeds **W. S. Stovall,** who has been transferred to St. Elmo, Ill. **R. D. Orr,** assistant district superintendent in Magnolia, Ark., will succeed Wible.

Personals

DAWSON

Arch Dawson, Houston division production engineer and division production superintendent for Union Oil Co., has been transferred to Tulsa as manager of operations in the Oklahoma division. Dawson succeeds **L. E. Fitts, Jr.,** who has resigned to open consulting offices. Dawson joined Union's Gulf division in 1947 as a field engineer.

Dr. R. W. Tess has been appointed a research supervisor at Shell Development Co.'s Emeryville, Calif., research center.

Erwin J. Poizner, formerly district geologist in Lafayette, La., for Southern Minerals Corp., has resigned to open consulting offices in Lafayette.

Wynne M. Adams, Tidewater Oil Co.'s district geologist in Houston, has been named district geologist in Midland, Tex. **James A. Kurfess,** formerly geophysicist in Bakersfield, Calif., has been transferred to Midland as district geophysicist for Tidewater.

Earl Bateman, independent operator, has been elected president of Rimrock Tidelands, Inc. He succeeds **H. L. Rowley,** who has resigned. Rowley will remain with the company in an advisory capacity. **Rex L. Shaver,** executive vice president and treasurer of Rimrock Tidelands, has been named a director.

WALKEY

John E. Walkey, assistant manager of process development at California Oil Co.'s Perth Amboy, N. J., refinery headquarters, has been promoted to manager of process development. He succeeds **W. S. Svenson,** who has been transferred to San Francisco. Walkey joined Caloil in 1957 after 12 years with California Research Corp.

Archie L. Crawford has been named field superintendent for Ryder Scott Management Co., Wichita Falls, Tex. Crawford formerly was foreman and superintendent with Lone Star Producing Co., New Idria Mining & Chemical Co., and Ada Oil Co.

Deaths

William H. Klintworth, 80, pioneer drilling contractor, died February 23 in a Tulsa hospital. Klintworth was active in Pennsylvania before moving to Tulsa in 1907. He was president of Exchange Drilling Co. before his retirement in 1938.

D. W. Johnson, 77, retired Atlantic Refining Co. statistician, died February 23 in Miami, Ariz. Johnson served as vice president, secretary, and general manager of Gilliland Oil Co. and Reserve Petroleum Corp., subsidiaries of Atlantic, from 1922-29.

B. Frank Bridges, 69, retired president of Canbridge Corp., Ltd., Calgary, died February 21 at his home in Rancho Santa Fe, Calif., after a heart attack. Bridges joined Gypsy Oil Co., predecessor of Gulf Oil Corp., in 1917. He was head of Canadian operations for Falcon Seaboard Drilling Co. before forming Canbridge Corp.

Francis E. Foster, 52, general sales manager for Bradford Supply Co., died February 19 in Springfield, Ill. Foster was enroute from Tulsa to his home in Bradford, Pa. He had been completing plans to move the general sales office to Tulsa.

Francis V. Maloney, 52, supervisor for Shell Pipe Line Corp., died February 22 in a Houston hospital.

Henri M. van Bemmelen, 56, head of land and leasing in Standard-Vacuum Oil Co.'s exploration department in New York, died February 19 in Utrecht, Netherlands, of pneumonia. He had been visiting relatives in the Netherlands after attending a meeting of the UN Economic Commission for Asia and the Far East in New Delhi, India. He was a member of the U.S. delegation. Van Bemmelen joined Stanvac in Indonesia in 1935. He was a managing director and chief representative for the company there before assignment to the New York headquarters in 1950.

L. C. (Bull) Heydrick, 84, owner of Heydrick Mapping Co., Wichita Falls, Tex., died February 21 in Wichita Falls. Heydrick was the son of an oil industry pioneer, Jesse Heydrick, who helped organize Wolverine Oil Co. in Pennsylvania in 1859. Wolverine was the second company organized to drill for oil.

A. B. Foster, 85, retired Houston oil operator, died February 25 in Houston. He had been president of Gulf Dome Oil Co. and was once associated with the old Houston Oil Co. In the 1920's he was oil editor of the Houston Chronicle. His brother, the late M. E. Foster, founded the Chronicle and was its editor-publisher for many years.

Homer Eugene Mead, 70, former partner in Mead Brothers, Inc., died February 18 in Woodland Hills, Calif. The Mead company was active in Kansas and Oklahoma at one time.

Bayard C. Lawrence, 54, deputy general manager, Africa division, of Caltex West Co. division of California Texas Oil Corp., died recently in New York after a long illness. Lawrence joined The Texas Co. in 1927 after graduation from Washington University, St. Louis. He was transferred to China in 1929 and worked in the marketing division there until 1941. After the war he became general manager, Texas Co. (China) Ltd., and later was with Texaco and Caltex affiliates in Malaya, Siam, and Japan. He became managing director of Caltex (Africa) Ltd. in 1952 and was named deputy general manager for Caltex West in New York in 1956.

Henry F. Vogt, 79, retired chairman of Cutler-Hammer, Inc., Milwaukee, died February 16 in St. Petersburg, Fla., after a heart attack. Vogt joined the company in 1900.

Roy C. Sears, Sr., retired Cleveland, Okla., drilling contractor, died February 18.

Morris B. Finkelstein, 81, retired Houston oil operator and charter stockholder in Humble Oil & Refining Co., died recently in Houston. He had been ill for several months. Finkelstein bought stock in the newly formed Humble Oil & Refining in 1911.

William P. McCarthy, 73, pioneer Texas oil man, died February 19 at his Houston home. He was the father of well-known wildcatter Glenn McCarthy. The elder McCarthy entered the oil industry at Spindletop. He was superintendent for Port Arthur Gas Co. at one time and later operational head of a Houston oil syndicate.

Papua. A route to a new drilling site is prepared. The British Petroleum Company's search for oil is a world-wide operation.

BP

It's the refinery-shift season

BY JOHN C. CASPER

SPRING IS NOT HERE, but every refiner's attention turns to gasoline by the first of March. There are many supply-distribution questions that must be answered before the summer gasoline season starts.

. . . Are gasoline stocks too high?

. . . What will demand average for the summer quarters?

. . . How much should refinery runs be reduced in March?

. . . What yield pattern will produce the greatest refinery realization?

Many suppliers believe gasoline stocks are too high even though the total is down about 10,000,000 bbl. from a year ago. Last year at the March meeting of the Texas Railroad Commission, economists of 20 major oil companies listed what they considered desirable gasoline inventories for the end of March. The range was from 160,000,000 bbl. to 200,000,000 bbl. (OGJ, March 31, 1958, p. 54).

Based on these estimates, the industry has too much gasoline in storage. The total topped 200,000,000 bbl. on February 13. Unless runs are held to a very low level, at least 4,000,000 bbl. more will be added to storage in February and another 2,500,000 bbl. in March. These increases will produce an end-of-March inventory level about in line with the total reported for March 31, 1957. This is a familiar pattern.

Stocks tend to climb until soft markets force a cutback or at least a leveling off while demand is catching up. Last year was a cutback year with a reduction of about 10,000,000 bbl. in gasoline stocks.

Inventories have climbed faster than demand over the past 7 years. The chart on the left shows days' supply of gasoline since 1952. For the first year of the series, the average of month-end stocks was 40.7 times total daily average demand for gasoline. The ratio indicated 48.7 days' supply during 1957 and 48.5 days' for 1958.

Some suppliers believe this increase has been necessary because of the trend toward more grades of motor fuel and the need for grade separation at terminals. Others believe that the increase is an indication of excessive stocks.

Demand will be greater this summer. Most industry estimates of domestic demand call for gains of about 4% for gasoline. The chart on the right shows trends in total gasoline demand for the past three winters. Note that demand was very good in October but that the drop from October to November was greater than normal. In making comparisons with gasoline demand last winter, we must keep in mind that gasoline demand was low during the 1957-1958 winter.

Fourth-quarter domestic demand in 1958 was up 5% over the same quarter of 1957, but it was up the same amount over 1956 and only 6.1% over the fourth quarter of 1955. If first-quarter gasoline demand shows a good gain over the first quarter of 1958, the increase should be judged on the basis of a very low level of demand last year.

It will take a gain of 2.3% to get out of last year's hole before the suppliers can start counting any real gain.

The over-all gasoline problem was complicated by high yields of motor fuel in the late months of 1958. Record refinery runs in December, needed to meet distillate demand, were accompanied by high yields of gasoline.

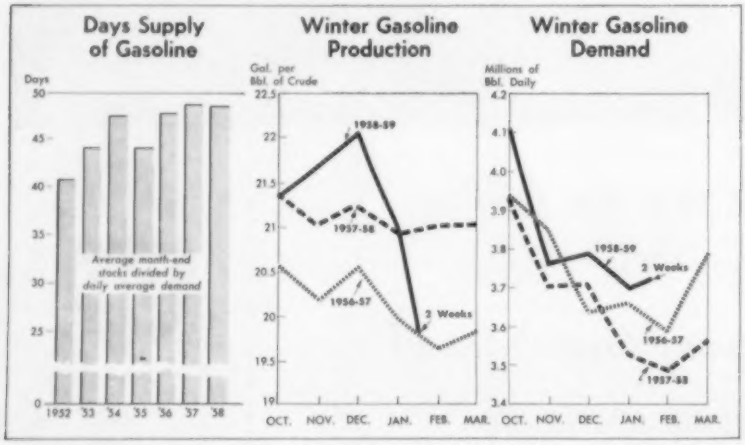
For every barrel of crude in December, refiners made 22.05 gal. of gasoline, the highest winter ratio since the end of World War II.

The December buildup of gasoline stocks called for a shift in yields, starting with the first of the year. Some refiners believe that the gasoline yield should be kept low until stocks drop to more desirable working levels.

Since total demand starts its seasonal decline in March, refining programs will call for a reduction in runs as well as low gasoline yields.

A quick look at the highlights . . .

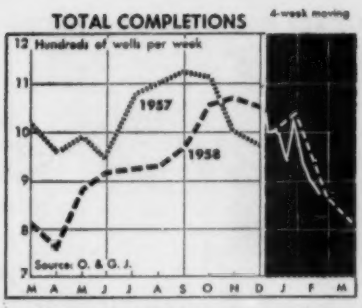
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,217,641	UP	49,728	DOWN	433,745
Crude stocks	256,032,000	DOWN	1,206,000	DOWN	28,727,000
Completions	870	DOWN	29	DOWN	58
Refinery runs	7,987,000	UP	33,000	UP	481,000
Gasoline stocks	204,987,000	UP	4,867,000	DOWN	8,129,000
Kerosine stocks	19,648,000	DOWN	305,000	UP	1,052,000
Distillate stocks	84,021,000	DOWN	4,234,000	DOWN	12,647,000
Residual stocks	55,530,000	DOWN	116,000	UP	95,000
Four-product stocks	364,186,000	UP	212,000	DOWN	19,629,000
Total imports	2,146,300	UP	297,800	UP	1,065,700

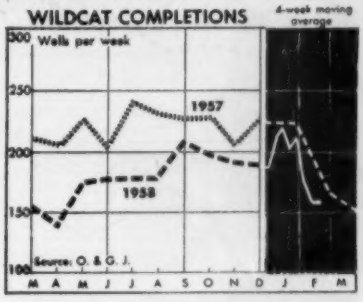


Active Rotary Rigs *

	2-23-59	2-16-59	2-24-58
Alabama	9	8	7
Arkansas	5	13	22
Arizona	....	....	1
California	80	77	85
Land	77	74	(†)
Offshore	3	3	(†)
Colorado	30	25	26
Florida	1	1	2
Illinois	7	15	47
Indiana	....	1	7
Iowa	3	3	3
Kansas	129	134	117
Kentucky	2	3	4
Louisiana	327	304	327
North	35	27	30
S.-Inland waters	145	140	(‡)
S.-Land	107	98	231
Offshore	40	39	66
Maryland	1	1	....
Michigan	18	17	9
Missouri	....	....	....
Montana	17	20	26
Mississippi	54	57	40
Nebraska	23	18	19
Nevada	....	....	....
New Mexico	106	94	109
New York	....	....	1
North Dakota	30	27	29
Ohio	1	2	1
Oklahoma	220	213	182
Oregon	....	....	....
Pennsylvania	12	11	10
South Dakota	1	1	....
Texas	696	693	727
S.-Inland waters	8	8	(‡)
S.-Land	128	124	153
Offshore	....	1	2
North-East	142	158	(†)
West Central	269	263	(†)
West	149	139	(†)
Utah	37	33	42
Washington	1	1	....
West Virginia	3	3	4
Wyoming	48	51	50
Total U. S.	**1,861**	1,826	1,897
Western Canada	229	222	237
Eastern Canada	....	....	....
Grand total	2,090	2,048	2,134

*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.



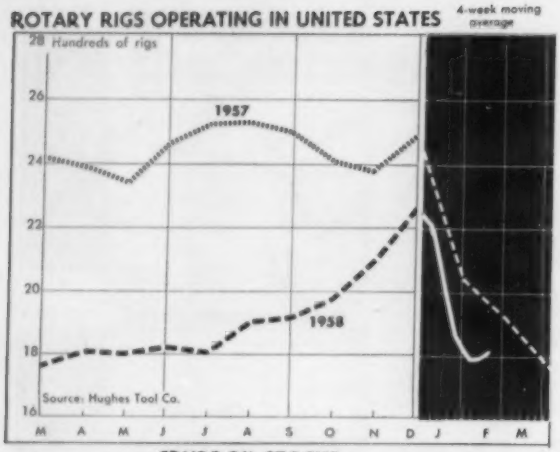


WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 21, 1959

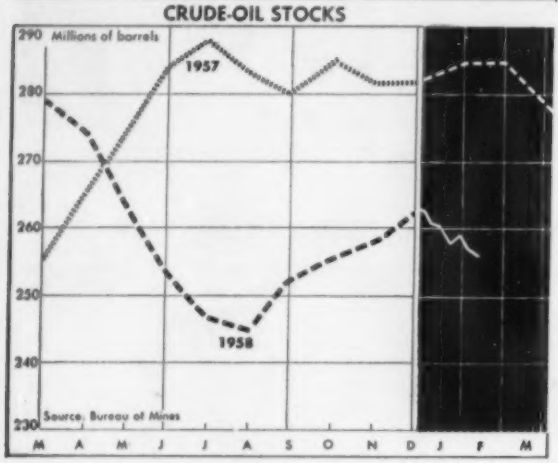
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	1	1	0	0	0	0	11,575	20	14	0	0	0	0	0	3	6
Arkansas	22	13	0	2	5	2	72,639	152	111	1	0	0	0	1	27	22
California	37	32	0	1	4	0	178,647	254	311	6	4	0	0	2	62	57
Colorado	13	5	0	0	8	0	69,197	107	108	5	2	0	0	3	52	61
Illinois	31	14	0	0	17	0	64,593	356	311	5	0	0	0	5	57	60
Indiana	8	4	0	1	3	0	14,619	97	99	3	0	0	0	3	30	31
Kansas	60	31	0	1	28	0	219,464	613	571	13	2	0	0	11	143	123
Kentucky	32	10	0	1	21	0	36,144	234	132	8	3	0	0	5	24	15
Louisiana	76	34	7	2	33	0	598,222	542	508	9	2	0	0	7	81	62
North	32	14	0	1	17	0	142,943	200	169	7	2	0	0	5	44	26
South	37	15	7	1	14	0	388,516	287	267	2	0	0	0	2	36	33
Offshore	7	5	0	0	2	0	66,763	55	72	0	0	0	0	0	1	3
Michigan	12	6	0	1	5	0	35,267	82	50	4	0	0	0	4	24	18
Mississippi	8	3	1	0	4	0	91,572	100	69	4	1	0	0	3	50	40
Montana	5	3	0	0	2	0	33,457	42	67	2	0	0	0	2	14	36
Nebraska	19	6	0	0	13	0	113,043	101	101	9	0	0	0	9	45	49
New Mexico	30	21	1	1	7	0	119,983	262	363	2	0	0	0	2	25	59
New York	0	0	0	0	0	0	0	52	85	0	0	0	0	0	1	5
North Dakota	13	7	0	0	6	0	94,261	70	66	8	3	0	0	5	20	24
Ohio	11	6	0	4	1	0	31,529	121	137	0	0	0	0	0	4	3
Oklahoma	152	81	3	5	53	10	504,805	849	1,113	19	2	0	1	16	142	162
Pennsylvania	0	0	0	0	0	0	0	59	17	0	0	0	0	0	1	2
Texas	304	166	10	11	113	4	1,363,340	2,819	2,914	67	7	2	3	55	555	629
Dist. 1	21	7	1	0	13	0	58,212	208	145	8	0	0	0	8	53	62
Dist. 2	13	2	0	3	8	0	78,521	118	89	5	0	0	1	4	38	24
Dist. 3	19	8	1	0	10	0	142,454	172	201	2	0	0	0	2	52	33
Dist. 4	20	6	4	1	9	0	107,180	205	189	5	2	1	0	2	60	65
East	21	10	3	1	7	0	94,704	171	219	4	0	0	0	4	41	59
Dist. 7-B	32	14	0	2	16	0	109,456	343	359	14	1	0	1	12	108	116
West	99	75	1	1	21	1	544,272	890	868	13	2	1	0	10	98	139
Dist. 9	63	33	0	2	25	3	154,607	508	634	13	1	0	1	11	85	111
Dist. 10	16	11	0	1	4	0	73,934	204	210	3	1	0	0	2	20	20
Utah	11	7	0	0	4	0	65,654	56	67	4	0	0	0	4	16	11
West Virginia	9	2	0	6	1	0	22,948	106	121	1	0	0	0	1	4	4
Wyoming	16	9	0	1	6	0	85,113	126	114	4	1	0	0	3	51	47
Misc.	0	0	0	0	0	0	0	11	21	0	0	0	0	0	8	16
Total U. S.	**870**	461	22	37	334	16	3,826,072	7,231	7,470	**174**	27	2	4	141	1,439	1,542
Previous week	899	418	22	114	314	31	3,617,694	.....	.....	150	13	3	5	129	.....	.....
Cum. 1959	7,231	3,627	191	482	2,742	189	30,772,213	.....	.....	1,439	148	20	49	1,222	.....	.....
Western Canada	48	23	0	2	23	0	256,119	311	353	22	2	0	0	20	110	116

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-14-59	2-7-59	2-15-58
Pennsylvania	2,528	2,561	2,805
Other Appalachian	1,668	1,418	1,527
Illinois, Indiana, Michigan	9,452	9,535	11,380
Nebraska and North Dakota	2,394	2,204	2,413
Kansas	9,177	9,343	9,602
Oklahoma	15,775	16,085	18,838
Arkansas	2,051	2,135	2,964
Louisiana	18,011	17,187	20,234
North	2,920	3,037	3,332
South	15,091	14,150	16,902
Mississippi, Alabama, Florida	2,336	2,381	2,699
New Mexico	8,635	8,877	9,344
Texas	115,072	114,938	124,829
East Texas	8,430	8,898	9,500
West Texas	57,166	56,335	55,164
Texas Gulf	19,448	19,513	26,629
Other Texas	30,028	30,192	33,536
Wyoming	13,361	13,049	14,442
Other Rocky Mountain	8,864	9,176	7,028
California	34,403	33,616	38,000
Foreign	†12,305	14,733	18,654
Total	**256,032**	257,238	284,759

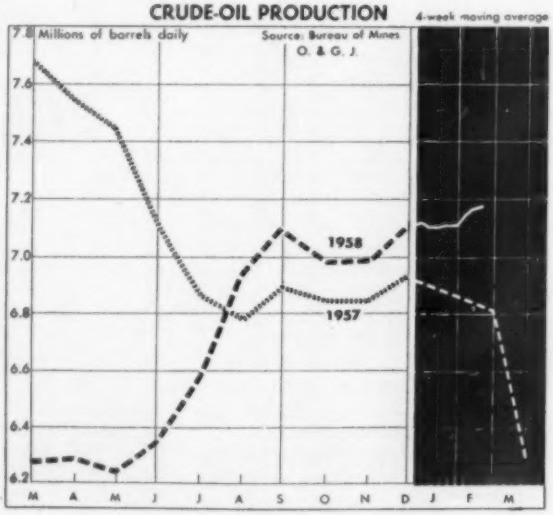
*Bureau of Mines. †Includes 4,151,000 bbl. in California.

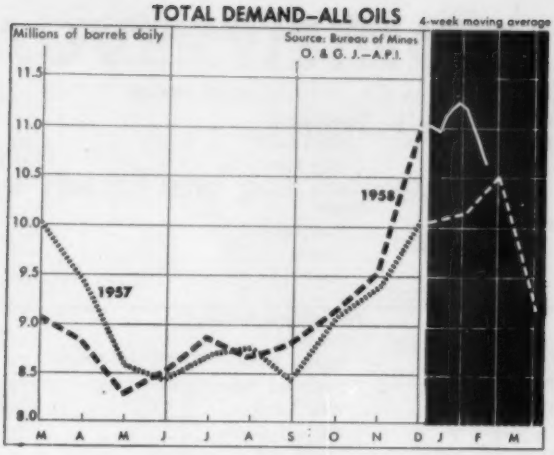
DAILY AVERAGE PRODUCTION FOR WEEK

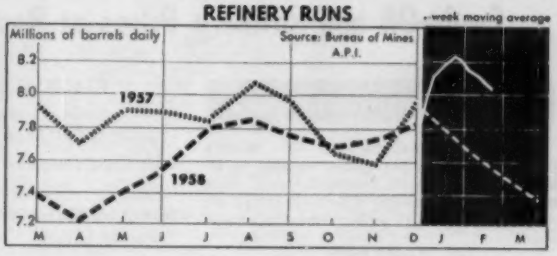
	February 21, 1959 Crude oil	Lease condensate	Total	Feb. 14 total
Alabama	15,550	.....	15,550	15,550
Arkansas	77,350	150	77,500	77,325
California	845,300	.....	845,300	846,800
Colorado	128,900	.....	128,900	128,700
Eastern	40,100	.....	40,100	40,300
Florida	1,250	.....	1,250	1,250
Illinois	224,500	.....	224,500	221,900
Indiana	32,900	.....	32,900	33,400
Kansas	†330,416	.....	†330,416	†318,338
Kentucky	65,000	.....	65,000	64,500
Louisiana	842,200	100,300	942,500	942,975
North	111,200	3,800	115,000	115,475
South	731,000	96,500	827,500	827,500
Michigan	25,100	.....	25,100	24,700
Mississippi	116,500	5,200	121,700	121,700
Montana	79,500	.....	79,500	79,100
Nebraska	59,500	.....	59,500	60,000
Nevada	100	.....	100	100
New Mexico	284,500	6,100	290,600	290,600
North Dakota	37,800	.....	37,800	36,900
Oklahoma	†574,300	.....	†574,300	†536,300
Texas	2,812,000	70,500	2,882,500	2,882,500
Dist. 1	43,000	2,000	45,000	45,000
Dist. 2	122,000	8,300	130,300	130,300
Dist. 3	386,000	34,000	420,000	420,000
Dist. 4	199,000	8,500	207,500	207,500
Dist. 5	32,000	500	32,500	32,500
Dist. 6	124,000	7,400	131,400	131,400
East Texas Field	162,000	.....	162,000	162,000
Dist. 7-B	144,000	150	144,150	144,150
Dist. 7-C	140,000	3,750	143,750	143,750
Dist. 8	1,145,000	3,000	1,148,000	1,148,000
Dist. 9	208,000	1,900	209,900	209,900
Dist. 10	107,000	1,000	108,000	108,000
Utah	108,300	.....	108,300	110,000
Wyoming	334,000	.....	334,000	334,700
Others	‡325	.....	‡325	‡325
Total U.S.	7,035,391	182,250	**7,217,641**	7,167,913
Change from previous week, up			**49,728**	
Canada	†593,000	.....	†593,000	†582,700
Total U. S. production—Jan. 1-Feb. 21				371,964,400 bbl.
Same period last year (crude plus cond.)				*355,869,338 bbl.

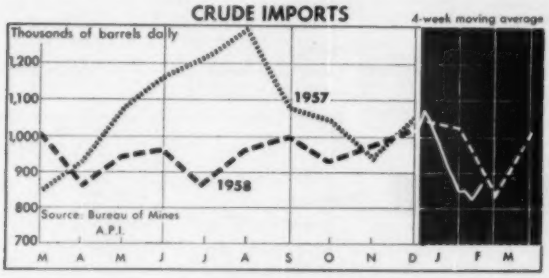
*Includes 8,520,125 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Washington, and Arizona.

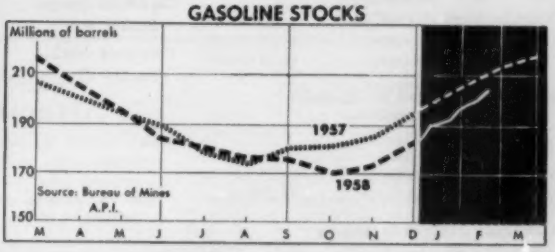
CRUDE-OIL PRODUCTION

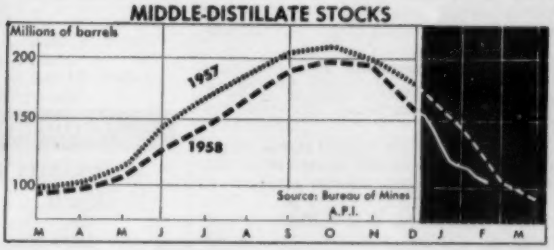


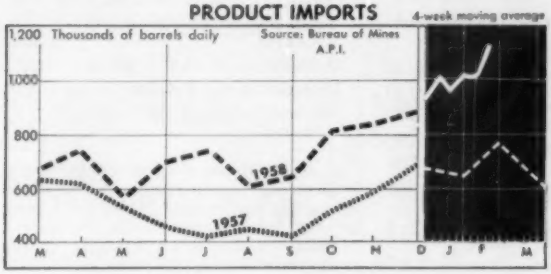

TOTAL DEMAND—ALL OILS
4-week moving average
Millions of barrels daily
Source: Bureau of Mines
O. & G. J.—A.P.I.
1957
1958
M A M J J A S O N D J F M

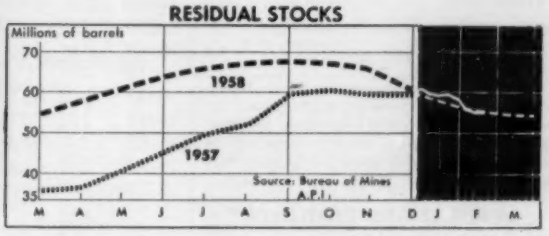












API REFINERY REPORT—FEBRUARY 20, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,233	585.6	62.3	413.4	181.4	43,713	9,611	30,066	10,921	1,123	474.2	34.9	313.7	187.4
Appalachian:														
District 1	102	41.4	6.3	22.7	12.3	4,629	483	2,039	244	99	40.1	5.6	24.7	10.7
District 2	115	54.2	8.1	23.7	14.1	2,875	287	790	275	110	54.7	6.3	22.9	12.6
Ind., Ill., Ky.	1,486	693.4	57.1	433.7	187.9	35,350	3,496	13,216	3,356	1,462	708.0	81.0	347.0	211.5
Minn., Wis., Dak.	107	53.6	6.6	26.9	14.4	6,524	620	3,398	450	108	50.7	7.0	28.4	14.1
Okla., Kans., Mo.	785	424.6	25.4	219.0	33.1	21,689	932	6,667	783	724	394.1	20.3	175.1	38.7
Inland Texas	292	204.3	10.4	48.0	21.9	8,653	330	1,305	2,173	266	194.8	8.4	53.0	21.1
Tex. Gulf Coast	1,736	834.1	128.4	553.0	188.0	28,528	1,859	8,120	6,143	1,676	864.4	140.5	423.6	196.0
La. Gulf Coast	720	386.7	77.0	210.4	51.3	12,515	1,005	3,764	1,434	597	355.7	63.0	128.4	45.0
N. La. and Ark.	103	33.0	7.2	23.2	5.3	5,152	460	1,322	67	80	31.4	5.0	17.3	8.5
Rocky Mountain:														
New Mexico	24	12.7	0.2	3.0	2.6	626	42	160	22	22	9.1	0.3	4.0	3.2
Other Rky. Mt.	214	103.3	2.3	42.4	20.1	6,777	193	2,449	758	270	134.5	3.4	63.2	35.2
West Coast	1,070	540.0	6.4	191.3	290.7	27,956	330	10,725	28,904	987	455.1	4.6	119.3	325.0
Feb. 20, 1959	7,987	3,966.9	397.7	2,210.7	1,023.1	204,987	19,648	84,021	55,530	7,524	3,766.8	380.3	1,720.6	1,109.0
Feb. 13, 1959	7,954	3,823.1	421.7	2,060.0	1,050.6	200,120	19,953	88,255	55,646	.....	.....	.....	.....	.....
Feb. 21, 1958	7,506	3,705.3	338.0	1,715.4	1,109.9	213,116	18,596	96,668	55,435	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.25-11.625
Premium (99 octane)	14.25-14.625

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	9.875-10.25
Regular (92 octane)	10.125-10.50
Premium (97 octane)	11.25-11.625
Premium (98 octane)	11.375-11.75

California (rack) (Los Angeles):

★ Regular (88 octane)	13.00
★ Premium (94 octane)	14.50-15.00
★ Premium (98 octane)	15.10-16.10

Caribbean area (cargoes):

Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	11.00
Diesel oil (58 d.i. and above)	10.75
Distillate No. 1	10.75
Distillate No. 2	10.00

Gulf Coast (cargoes):

Kerosine 41-43	10.375
Distillate No. 2	9.875

New York Harbor (barges):

Kerosine 41-43	11.50
Distillate No. 2	11.00
Diesel fuel, 48-52 d.i.	11.25

Caribbean area (cargoes):

Distillate No. 2	9.875

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max. 1% S)	$2.00-2.05

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

Bunker C fuel	$2.37

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal* Hill, Calif.	Okla-homa*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Another Oklahoma (sweet) schedule has a top of $3.08 with gravity variations to $2.52 for below 20°. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 12-22-58.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00
Ville Platte	3.30

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.05
Middle District	3.87
Southwest Pennsylvania	3.58
West Virginia	3.40
Buckeye Grade	3.25

Illinois Basin 3.00

Canada:

Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.51
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	2.90
Tia Juana medium, 26°-26.9°, Amuay*	2.40
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):

Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 30.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05

Middle East, E. Mediterranean:

Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., lean (ATRS —20%)	$2.28
★ Carib.-U.S.N.H., dirty (Scale —48.5%) (8s. 9d.)	1.23
★ Carib.-U.K., dirty (Scale —50%) (16s. 3d.)	2.28
★ P.G.-U.K., dirty (Scale 56%) (27s. 4d.)	3.83

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FOR SALE—One Wilson Mogul Spudder complete with lightplant and Doghouse. A Bargain. Rebstock Bros., Carmi, Illinois.

USED PIPE AND USED TANKS—For Sale. Rogers & Wright, Incorporated, 216 West Second Street, Tulsa, Oklahoma; 710 Peoples Building, Charleston, West Virginia.

60-L BUCYRUS-ERIE SPUDDER, serial #103605, trailer mounted, top to bottom tools. Inventory on request. Price $15,000.00. Approximately half price. Cummins Drilling Company, Altamont, Illinois, Phone 3-1131.

1. Joy 300 Trailer Rig w/7 x 10 G.D. Pump, 3½" D.P., Drill Collars, Dog House, etc., complete rig.
2. Emsco Type A-10 Triplex Pump, excellent condition.
3. Westinghouse 3 Phase, 440V, 60 Cy., 100 HP @ 1150 RPM w/variable speed control panel.
4. GD Slush Pump, 5 x 8, FD Model on 3 member skid w/sheave, guard, suction, L525 Buda power.
5. Rotary blowout preventer, Type E1 Guiberson Air Drilling pack-off rubbers.
6. Shale Shaker, Model "K," Linda—New.
7. Keystone 74 Trailer Mounted Spudder, 10" to 3" tools.
8. Used 4½" 9.5# CW Casing.
9. Used 3½" x 4½" Drill Pipe (Structural use).
10. Baker Cable tool core barrels #5 & 6 with parts.
11. Dowdco Diamond Core Barrel, 6⅛" x 50' w/7¾" OD x 4⅜" I.D. diamond bit and tools.

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1129 E. 15th St. Phone DI 3-8463
Box 3655 Tulsa, Oklahoma

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PORTABLE Gas Compressor Unit—Joy Model WGB-110 single stage 3x7 compressor driven by 145 GKU Waukesha Engine. Rated 1 MM SCFD delivery at 400 psi suction and 800 psi discharge pressures. Maximum working pressure of cylinder 2,000 psi. Recently shut down unit still on location in good condition. Price $7,800.00. The Plomo Company. Attn.: H. K. Dixon, P. O. Box 1186, Robstown, Texas.

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6,000' Cardwell Model "D" on specially designed Lee C. Moore 96' Trailermast. Triple axle 10:00x15 tires. 440 HP LeRoi Engines, Wheland HP 14,000 pump driven from compound. Late Model rig attractively priced without drill pipe or collars. Located in Oklahoma. Write for Inventory.

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(LIMITED SERVICE)
15,000 Ft. 16" O.D., .281 Wall, 47.2# Electricweld
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All in app. 40 Ft. DRL, Beveled and Mill Tested to 650 Lb.
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TULSA, OKLAHOMA
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USED PUMPING UNITS: American T 7D-25, no power. American T 12D-80, 10 H.P. elec. motor. Cabot C-12-E, 10 H.P. elec. motor. National E 21 SB—160 D.W. 25 H.P. elec. motor. Rare item: Used 2½" reg. (non-upset) R-1, Smls., 10-thrd. tubing. Bellaire Pipe & Supply Co. 8020 Lyons Ave. OR 4-2763. Houston 29, Texas.

FOR SALE in good condition complete low pressure gas gathering and compression plant, 300 h.p. engine and two stage compressor for delivery of gas to 1000 psi—several thousand feet of 3 inch, 4 inch and 6 inch lines—glycol dehydration and gas cooling equipment. For details and price write P. O. Box 311, Hammond, Louisiana.

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Baldwin	6	VO	1000	8	650
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10—Steel 200—3,200 sq. ft.
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6'x36' 10 Tr. 480#	2'x45' 24 Tr.
4'x50' 12 Tr. 450#	18"x32' 15 Tr. 160#
4'x57' 10 Tr. 250#	4½'x17' 500#
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FOR SALE—Bucyrus-Erie, 36L, good condition. 10" to 4" tools, steel doghouse, lightplant, 100 bbl. water tank, 500 gal. butane tank; White winch truck; 30' tandem float; many extra fishing and drilling tools. Everything goes. Now drilling. Phone 422, Caney, Kansas, after 6:00 P. M.

SACRIFICE FOR $25,000—Complete Rig Ready to go. 8,500 foot. Located Ward County, North Dakota. Rig in Good Condition except some drill pipe needs straightening. 64B Oilwell. Oilwell mast. G. D. 7¼x14 pump. 2—D-17000 Cats or 2 N.K.U. Waukeshas. Will furnish complete list to interested parties. Ph. 9-3193—6-6123, Box 1724, Billings, Montana.

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4—4,500 sq. ft. Admiralty Heat Exchangers
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4,600 ft. 16" O.D., .188" Wall, 31.66 lbs. Armco Spiralweld Steel Pipe, Manufactured to ASTM specification A-139, Grade B, lined, coated and wrapped in accordance with AWWA C-203 specifications. 30 ft. lengths with ends prepared for Dresser couplings.
Priced Attractively for Quick Sale from Jenks, Oklahoma.

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GEOLOGIST—Independent Oil Producer wishes Geologist with experience in Northern Oklahoma and Southern Kansas. Write background, experience and qualification to Box L-197, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES ENGINEER needed, for work with oil and gas industries in Rocky Mountain area. Experience in control equipment desirable. Some travel required. Excellent growth opportunities. Salary open. Send photograph and complete resume so interview may be arranged. Box L-213, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

ENGINEERS WANTED immediately by Federal Power Commission, Washington, D. C., and other locations. Regulatory experience desirable but not essential. Salary range $4490-$10,130. Civil Service positions. Write Director of Personnel, Federal Power Commission, Washington 25, D. C.

GEOLOGIC EMPLOYMENT POSSIBLE—Dallas-Fort Worth area. Valuable up-to-date survey lists job potentialities with the top 60 oil organizations that require geologists. Confidential report includes appraisal of present opportunities and future plans with names and addresses. $5.00. Earth Science Listing Service, Box 991, Dallas 21, Texas.

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GEOLOGIST—desires foreign employment. Single. Six years domestic and foreign experience. Box L-221, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED TRANSLATOR—Scientific Russian translated with speed and accuracy. Have specialized for four years in fields of Geology and Chemistry. Box L-171, The Oil and Gas Journal, Tulsa, Oklahoma.

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FOREIGN ASSIGNMENT desired by drilling superintendent with administrative background, over 20 years continuous foreign experience. Box L-193, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, age 47, nine years experience Colombia, Venezuela, Portugal, Egypt; three years Rocky Mountain area. Chiefly regional surface studies. Fluent Spanish, Portuguese. Wide experience in logistics. Desire responsible position preferably aggressive Independent entering foreign exploration. At present in foreign residence. Full resume on request. Box L-201, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 39, 14 years diversified experience drilling, producing, reservoir, remedial operations on Gulf Coast. Box L-200, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION ENGINEER: ICS engineer; 11 years one company, area supervisor, reservoir tester, plant supervisor, pipe-line engineer, gas tester, and draftsman. Box L-206, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER. Age 37. Twelve years experience major companies in all phases of natural gasoline and cycling plants, pipelines and compressor stations. Supervisory experience. Some chemical plant work. Familiar with gas and products sales contracts. Desire responsible position in Southwest. Box L-215, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER—Thirteen years oil and gas production, design and installation of gas gathering systems and gasoline plants, sales engineering, supervision and management. Desire management of production and development for aggressive independent. Box L-204, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER: Graduate mechanical. Ten years pipeline experience; products and gas. Desires responsible position with established company in U. S. Box L-137, The Oil and Gas Journal, Tulsa, Oklahoma.

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PRODUCTION SUPERINTENDENT: Age 42, married, 20 years experience in oil production, 4 years of complete operation and management in Kansas and Wyoming. Can furnish excellent references. Will go anywhere. Write J. K. Fortner, 1217 Holland, Great Bend, Kansas, or phone GLadstone 3-3736.

PIPELINE ENGINEER, age 36, eleven years experience crude, products and gas pipelining, three years as Chief Engineer, registered, immediately available. Box L-216, The Oil and Gas Journal, Tulsa, Oklahoma.

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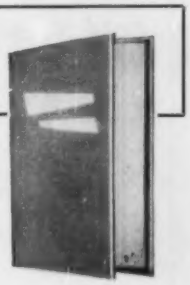

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WANT SHALLOW ACREAGE for three well test program, offset or extension, preferably farmout. Write U. S. Anderson, 8350 Santa Monica Blvd., Los Angeles 46, California.

⅛ INTEREST in 40 acre offset to production five hundred seventy-five feet well, Sorona sand. Well ready to drill—Box 628—Okmulgee, Oklahoma.

THREE SMALL gas-drilling sites at Monroe Center, Ashtabula County, Ohio, available for action and over-riding interest. Includes the 7-acre Monroe Township School grounds and 4-acre plot adjacent to Grange Hall. All in center of township; nearest, 11 acres, only 1,563 feet south of present drilling and less than 1,000 feet southeast from property line of farm where well is showing seven million. Bill Gibbons, P. O. Box 142, Conneaut, Ohio.

WELL FINANCED independent oil company wants outstanding drilling ventures; preferably offset to production. Box L-206, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

5,000 A. FOR TEST—near production Clark Co., Illinois. No cash—small O.R. W. V. Tarman—Martinsville, Illinois.

4000 ACRES of oil and gas leases in San Miguel, San Doval, Torrance, Lincoln, Chavis and Debaca counties, New Mexico. Also, one section of mineral lease in Santa Fe County. All are for out right sale or drilling contract. Full description or photostatic copies furnished on request. Write Box L-180, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—Minerals in Montana portion Williston Basin. Howard Helmer, Box 385, Poplar, Montana.

FOR SALE—Government 40 acre oil leases in Arizona, N. M. & Calif. You do no drilling yet. You share in fortunes made from oil on public lands. Payments if desired. Free information & maps of booming areas. Bids now accepted via mail. Universal Investors Corp. 30 W. Washington Street, Chicago 2 Illinois

Green County, Kentucky

Boom Area Leases—in fairway, 4400 acres in large or small blocks. Some direct offsets or close to production. Low lease costs for immediate drilling deals. Write for full particulars.

Box L-183, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

FOR SALE: New 150 acre oil and gas lease, John Inman Survey, Shelby County, Texas, priced $5.00 per acre; hot play. Write for information to C. A. Parker, Box 507, Center, Texas.

WANTED—ASSOCIATES in developing 2,000 acres on producing structures in Mamou field, Evangeline Parish, La. Phone Newbrough, MA 6247 or TU 0550, 1118 Richards Bldg., New Orleans, La.

KENTUCKY—Next Boom area—Shallow drilling Russell, Casey, Adair and Pulaski Counties. Large or small blocks. Low lease costs, drilling deals. Write—phone—wire for full particulars. W. V. Cravens, P. O. Box 261, Russell Springs, Kentucky.

HAVE 130 ACRE gas-oil lease. Proven production. 2,150 ft. or less. Ritchie County, W. Virginia. Need drilling capital. For details write D. A. S.—P. O. Box 303, Ellenboro, W. Virginia.

REAL ESTATE

INDUSTRIAL PROPERTY for sale—Located 2 miles east of Duncan, Oklahoma: 8 room office building, warehouse with platform, garage, pipe racks, 20 acres land, 5 acres fenced. Contact The Atlantic Refining Company, Att.: J. E. Craig, Duncan, Okla., or Jim Noel, Tulsa.

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Dallas 21, Texas
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READY TO DRILL 160 acres 800 ft. Peru sand. Good for water flood after flush production. Looks good for small investment. Box 2882, Wichita, Kansas.

FINANCIAL CONTACTS. Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817—51st St., Brooklyn, N. Y.

BUSINESS OPPORTUNITIES

DO YOU NEED an Exploration Dept.? North & West Oklahoma, Panhandles Texas & Oklahoma. Two geologists desire retainer or affiliation with group in this area. Major Co. and consulting experience. 18 years cumulative experience, young, aggressive. References exchanged. Box L-222, The Oil and Gas Journal, Tulsa, Oklahoma.

Large or Small Oil Operators

If you have production and would be willing to turn this into a Corporation being readied up for financing for a stock interest, please contact us immediately. Some cash consideration can be arranged after financing. Also small Corporations that would be better off merging are invited to write for full details. Box L-212, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT TO PURCHASE—Entire business or active partnership in light manufacturing, wholesale concern, or distributorships connected with oil business. Box 31 RO 532, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles, California.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable, to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW SERVICES WANTED

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Box L-177, The Oil and Gas Journal, Tulsa, Oklahoma.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 3 parcels of land totaling 160 acres, within the known geologic structure of the Fiddler Creek field, Weston County, Wyoming, are offered for oil and gas leasing competitively through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P. M., MST, April 15, 1959, when bids will be opened. Full details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

LEGAL

SEALED BIDS will be received until 10:00 A. M., Mountain Standard Time, March 31, 1959, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, for oil and gas leases on 20 tracts of allotted lands, totaling approximately 2,400 acres, located in Apache County, Arizona. Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, attention: Branch of Realty, Window Rock, Arizona.
Sale #62.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 307.05 acres of land in three parcels within the known geologic structure of certain fields in Texas and Pawnee Counties, Oklahoma will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p. m., MST, April 1, 1959, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

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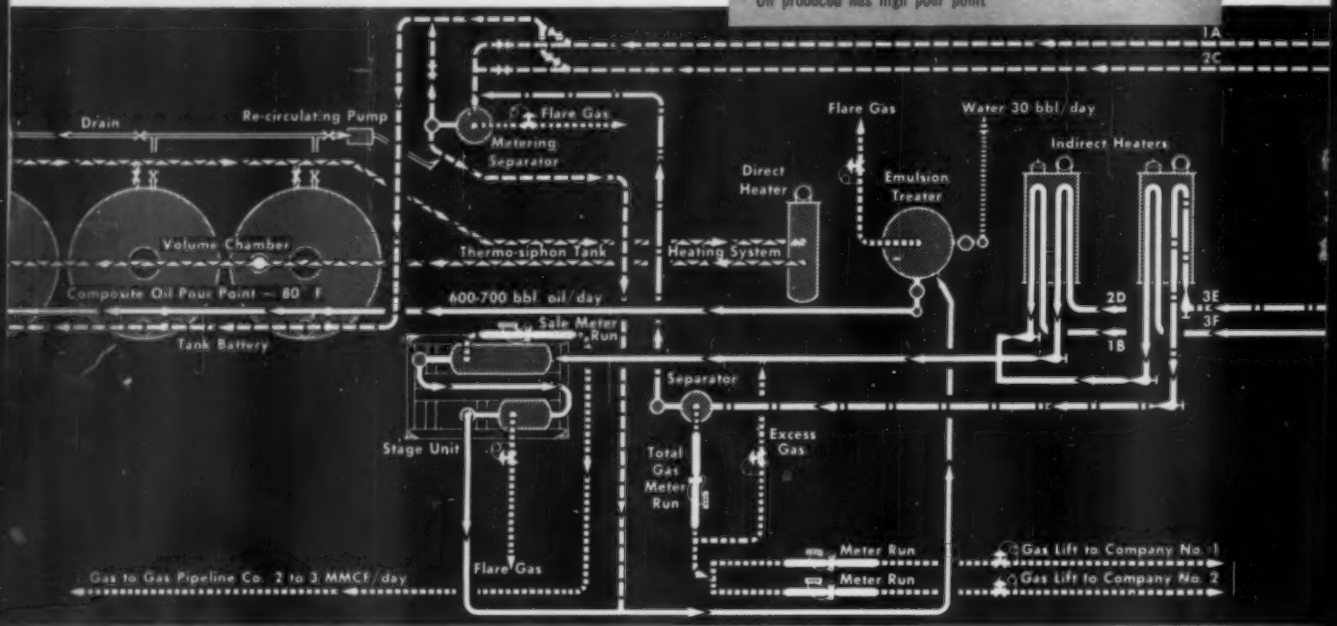

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Foaming-congealing oil from three zones is preheated in indirect heaters prior to separation in the special Monotube® stage separation unit. Separated dry gas is sold direct to pipeline.

Production from the two gas sands is separated in the metering separator, metered and commingled with oil production prior to treating in emulsion treater.

Each storage tank contains a set of vertical coils used as heat exchangers. Hot water is circulated thermosiphonically between water bath of direct fired heater and tank coils, to prevent high pour point oil from congealing. Gas from the distillate zone is used to gas-lift adjacent leases. The entire production arrangement is so complete and efficient, the pumper's time is held to a minimum.

Surface Equipment Includes:

● 5—Hi 500 Bbl. Bolted Galv. Cone Bottom Tanks w/Thermo-Siphon Vertical Heating Coils ● 2—4′ x 10′ 2xx4-14Y Indirect Heaters ● 1—6′ XCP Emulsion Treater ● 1—2′ x 10′ Direct Fired Horizontal Heater ● 1—30″ x 10′ 3MDF-1030-15x Defoaming Stage Separation Skid Mounted Unit ● 1—2′ x 6′ 10N, 1000 PSI W. P. Separator ● 1—30″ x 10′ 125 PSI W. P. Metering Separator

All equipment in this installation designed, manufactured, serviced and guaranteed by National.

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TULSA, OKLAHOMA

QUICK BALANCING

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★ **LOW OPERATING PRESSURE**—Large Air Cylinder

★ **MORE CONSTANT COUNTER-BALANCE**—Giant Air Reservoir

★ **EASY STARTING**—Cut-off Valve Retains System Air During Shut Down

★ **REDUCED WEIGHT**—No Cast Iron Counterbalance

★ **REDUCED FOUNDATION COST**—Compact Design

★ **CLAMP TYPE HOLD-DOWN**—Easy to Install and Align

★ **PORTABLE BASE**—Optional Wide Base Unit for Test Wells

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